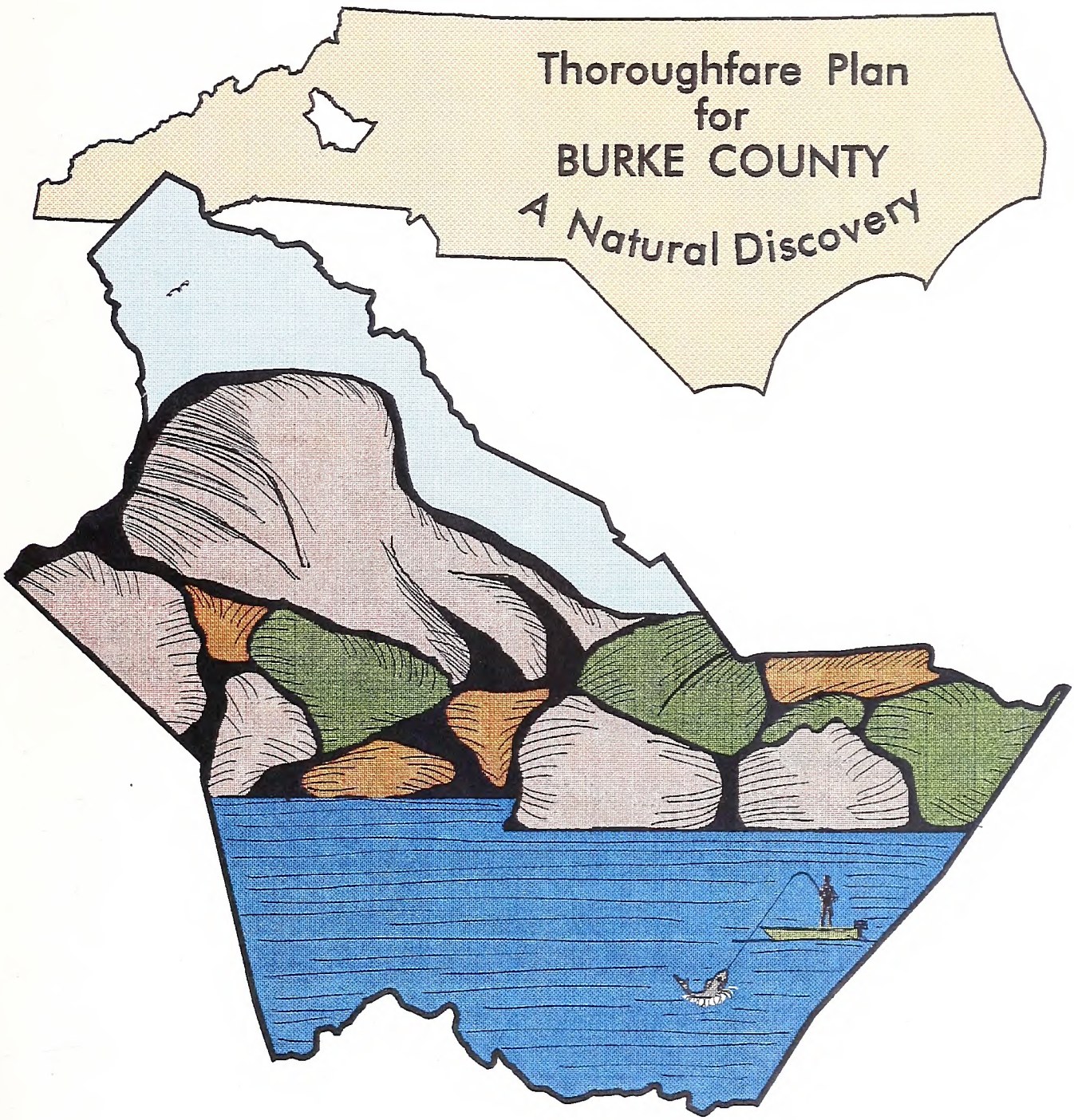
North Carolina Department of Transportation
Statewide Planning Branch
Small Urban Planning Unit

Thoroughfare Plan for BURKE COUNTY

A Natural Discovery



February, 1996

Burke County
Thoroughfare Plan

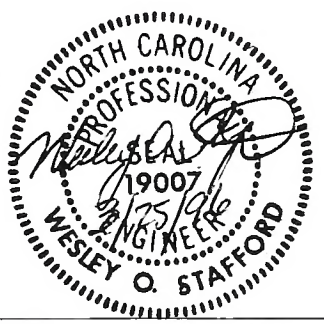
Prepared by the:

Statewide Planning Branch
Division of Highways
North Carolina Department of Transportation

In Cooperation with:

Burke County
The Federal Highway Administration
U. S. Department of Transportation

February, 1996



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Acknowledgments

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Executive Summary

This plan documents the finding of a thoroughfare study for Burke County. Below is a listing and brief description of these findings:

Minor Arterials

1. US64/NC 18 - widen from two-lane to four-lane between the Morganton Planning Boundary and Caldwell County.

2. US 64 - widen from two-lane to four-lane from the Morganton Planning Boundary to the McDowell County Line.

3. US 70 - widen from two-lane facility to a four-lane facility between the Rutherford College Urban Planning Boundary and the Hickory Urban Planning Boundary.

4. NC 18 - widen from two-lane to four-lane from the Morganton Planning Boundary to the Catawba County Line.

Major Collectors

5. NC 183 - this facility should be widened to provide a minimum 7.32 m (24 ft) cross section so to improve safety and operations.

6. NC 126 - widen to provide a minimum 7.32 m (24 ft) cross section. Also a paved shoulder should be considered for bike accommodations as needed.

7. SR 1001 - widen from two-lane to five-lane curb an gutter section from the Rutherford College Planning Boundary to the Caldwell County Line.

8. The Northeast Burke County Corridor - widen existing Rhodhiss Road, Oak Ridge Church Road, and Hickory Airport Road to minimum 7.32 m (24 ft) cross section. For recommendations to 9th Avenue (SR 1625) please see Hickory Thoroughfare Plan.

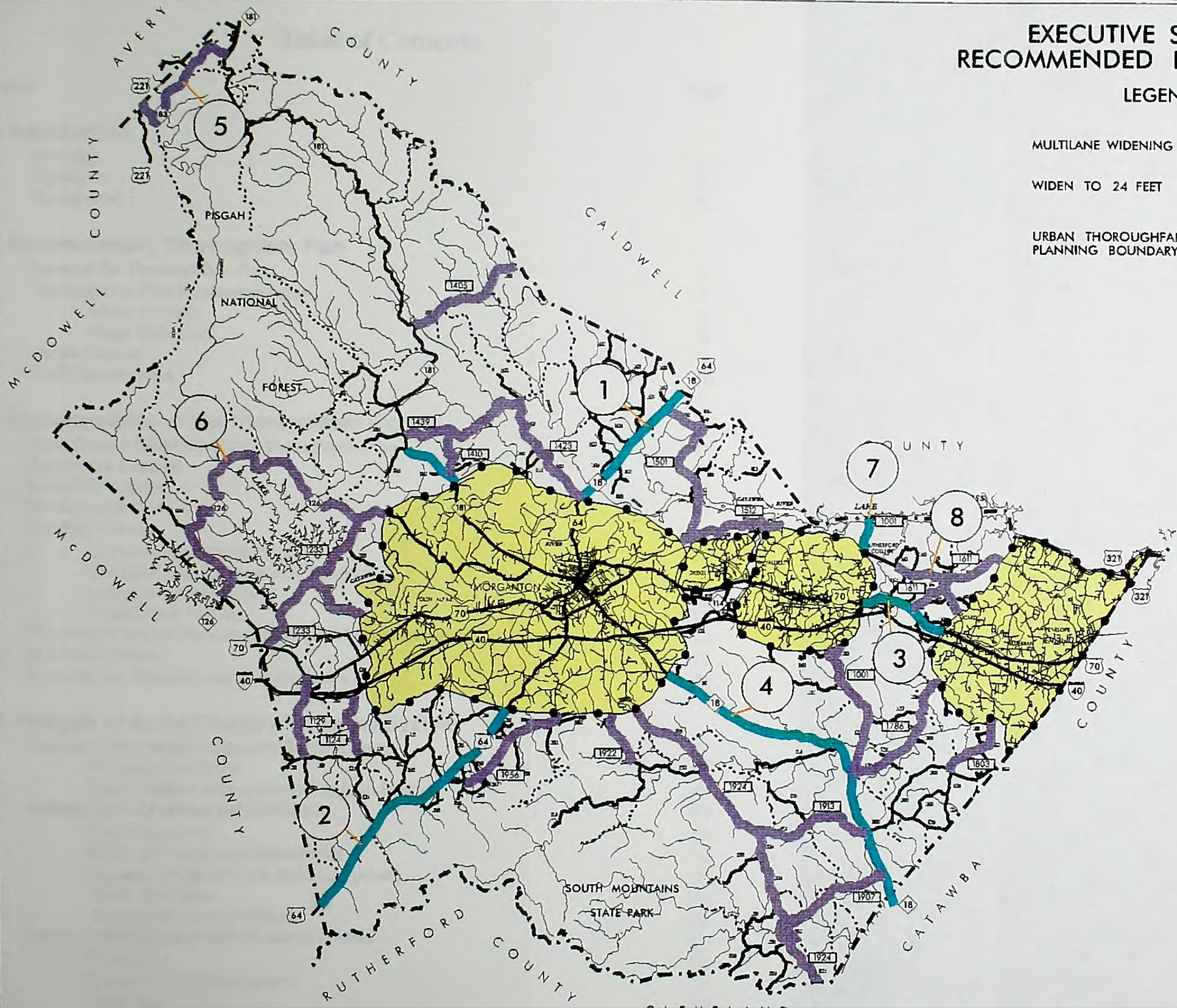
EXECUTIVE SUMMARY
RECOMMENDED IMPROVEMENTS

LEGEND

MULTILANE WIDENING

WIDEN TO 24 FEET

URBAN THOROUGHFARE PLANNING BOUNDARY



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BURKE COUNTY

NORTH CAROLINA

PREPARED BY

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS–GIS UNIT

IN COOPERATION WITH THE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

NOTE: THIS THOROUGHFARE PLAN ASSUMES 1996–2002 TIP PROJECTS FOR BURKE COUNTY HAVE BEEN IMPLEMENTED

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Chapter 1

Introduction

Overview

Officials of Burke County, prompted by a desire to adequately plan for the future transportation needs of Burke County, requested the North Carolina Department of Transportation's (NCDOT) assistance in conducting a thoroughfare plan study. The primary concern of the County Commissioners' was the increased development throughout the County and how this development might impact the existing transportation system.

The objective of thoroughfare planning is to enable the transportation network to be progressively developed to adequately meet the transportation needs of a community or region as land develops and traffic volumes increase. By not planning now for our future transportation needs, unnecessary costs to the physical, social, and economic environment may very well be incurred. Thoroughfare planning is a tool that can be used by local officials to plan for future transportation needs, while at the same time reducing the costs to our environment.

The primary purpose of this report is to present the findings and recommendations of the thoroughfare plan study conducted for Burke County. The secondary purpose of this report is to document the basic thoroughfare planning principles and procedures used in developing these recommendations. This report can be divided into three parts. The first part of the report, covered in Chapter 1, covers the highlights of the study. Chapter 2 and 3 provide a detailed description of the Thoroughfare Plan study recommendations and address different methods by which these recommendations can be implemented. The final chapter, Chapter 4, covers study procedures and findings.

Information that will be especially useful to the practitioners is provided in the Appendix. The principles of thoroughfare planning are covered in Appendix A, a detailed tabulation of all routes on the Thoroughfare Plan and a graphical representation of typical cross-sections can be found in Appendix B and C respectively. Information related to subdivision ordinances is covered in Appendix D. Finally in Appendix E is an index for secondary road numbers for Burke County.

Background

Burke County, located in west central North Carolina, was named for Dr. Thomas Burke, a member of the Continental Congress and Governor of the State of North Carolina. For a while, the western boundary of the county extended to the Mississippi River, and encompassed the future State of Tennessee. Land use is a mix of agricultural and commercial with most of the development along Interstate 40 in the central region of the county. Burke County also has National and State Forest Areas, Pisgah National Forest in the northwest corner and South Mountain State Park in the south central region. The major routes in Burke County include I 40, US 70, US 64, NC 18, and NC 181.

Highlights

Major highlights of the 1995 Burke County Thoroughfare Plan are outlined below. The Thoroughfare Plan map is shown in Figure 1. Projects included in the 1995-2001 Transportation Improvement Program (TIP) are shown in parenthesis.

1. Widen US 64/NC 18 to a multilane facility. (R-2549)

2. Widen US 64 to a multilane facility.

3. The Northeast Burke County Corridor: widen Rhodhiss Road (SR 1611) and Oak Ridge Church Road (SR 1614) to provide 3.66m (12-foot) lanes as part of TIP project R-2920.

4. Widen US 70 to a multilane facility.

5. Widen SR 1001 to a multilane facility.

6. Widen NC 181 to a multilane facility.

7. Widen NC 18 to a multilane facility.

The North Carolina Department of Transportation and Burke County are jointly responsible for the proposed thoroughfare improvements. Cooperation between the state and the county is of primary concern if the recommendations outlined above are to be successfully implemented. The plan has been mutually adopted by all parties, and it is the responsibility of the County to implement the plan following guidelines set forth in Chapter 3. This plan was adopted by Burke County on September 19, 1995, and by the North Carolina Department of Tranportation on February 2, 1996.

It is important to note that the recommended plan is based on anticipated growth within the County as indicated by past trends and future projections. Prior to construction of any of these projects, a more detailed study will be required to revisit development trends and to determine specific locations and design requirements.

SEPTEMBER 19, 1995

THOROUGHFARE PLAN

LEGEND

	Existing	Proposed
INTERSTATE		
OTHER PRINCIPAL ARTERIAL		
MINOR ARTERIAL		
MAJOR COLLECTOR		
MINOR COLLECTOR		
URBAN FREEWAY		
URBAN MAJOR THOROUGHFARE		
URBAN THOROUGHFARE PLANNING BOUNDARY		

ADOPTED BY:

Burke County — September 19, 1995

North Carolina Department of Transportation — February 2, 1996

RECOMMENDED BY:

Statewide Planning — January 16, 1996

PUBLIC HEARING — September 19, 1995

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BURKE COUNTY

NORTH CAROLINA

PREPARED BY

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS–GIS UNIT
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

BASE MAP

FIGURE 1

RECOMMENDED IMPROVEMENTS

LEGEND

MULTILANE WIDENING

WIDEN TO 24 FEET

URBAN THOROUGHFARE PLANNING BOUNDARY

AVERY COUNTY

McDOWELL COUNTY

CALDWELL COUNTY

PISGAH NATIONAL FOREST

MORGANTON

LAKE RHODHISS

CATAWBA COUNTY

RUTHERFORD COUNTY

McDOWELL COUNTY

SOUTH MOUNTAINS STATE PARK

CLEVELAND COUNTY

N

BURKE COUNTY

NORTH CAROLINA

PREPARED BY

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DIVISION OF HIGHWAYS–GIS UNIT

IN COOPERATION WITH THE

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FEDERAL HIGHWAY ADMINISTRATION

NOTE: THIS THOROUGHFARE PLAN ASSUMES 1996–2002 TIP PROJECTS FOR BURKE COUNTY HAVE BEEN IMPLEMENTED

FIGURE 2

Chapter 2

Recommended Thoroughfare Plan

Intent of the Thoroughfare Plan

Transportation is the backbone of a regions economic vitality. Without an adequate transportation system people cannot easily reach their intended destination, goods cannot be delivered to market in a cost effective manner, and investors may look to invest in better served areas. Recent trends such as regional economies, "just in time" delivery, increased automobile ownership, and increased migration away from the central cities and towns are taxing our existing transportation system and requiring that we put more emphasis on planning for our transportation future.

A thoroughfare plan study identifies existing and future deficiencies in the transportation system, as well as uncovers the need for new facilities. The thoroughfare plan also provides a representation of the existing highway system by functional use. This use can be characterized as a part of the arterial street system, the collector street system, or the local street system. A full description of these various systems and their subsystems is given in Appendix A.

This chapter presents the thoroughfare plan recommendations. It is the goal of this study that the recommended plan set forth a transportation system that will serve the anticipated traffic and land development needs for Burke County. The primary objective of this plan is to reduce traffic congestion and improve safety by eliminating both existing and projected deficiencies in the thoroughfare system.

Thoroughfare Plan Recommendation

Minor Arterials

These are the facilities that serve primarily through traffic movements in the County.

US 64/NC 18 - Classified as a minor arterial, this route is a vital corridor in Burke County. This route provides access between the Cities of Morganton in Burke County and Lenoir in Caldwell County. The design and character of this roadway suggests that to maintain an acceptable level of traffic service, vehicles per day should not exceed 10,000. The current Average Daily Traffic volume along US64/NC 18 was 7,300 vpd (vehicles per day) in 1994.

Traffic projected for the planning year (2025) indicates that traffic on this facility will increase to 11,000 vpd. To safely accommodate this increase, US 64/NC 18 should be widened to provide additional lanes (Appendix C, cross section A). This recommended improvement of US 64/ NC 18 between the Morganton Planning Boundary and Caldwell County is currently identified in the Transportation Improvement Program as a future needs project (TIP #R-2549).

US 64 - This section of US 64, west of Morganton, from the Morganton Planning Boundary to the McDowell County Line, is currently a 2-lane roadway that carries approximately 7,900 vehicles per day. With the current volume already nearing capacity and the proposal of the US 64 Bypass of Morganton this facility should be widened to a four lane facility within the study period. Along with the widening of US 64/NC 18 to a multilane facility and the new proposed US 64 Bypass, the widening of US 64 (cross section A) south of Morganton would give the County a continuous multilane facility.

US 70 - This roadway provides an alternative to I-40 through the urban areas in Burke County. Both routes run parallel to each other from Catawba County to McDowell County. There are only two sections of US 70 in Burke County that are not inside urban planning boundaries. These locations are from the Rutherford College Urban Planning Boundary to the Hickory Urban Planning Boundary and from the Morganton Urban Planning Boundary to McDowell County. US 70 is currently a 2-lane facility that carries between 1,700 and 8,900 vehicles per day. Traffic forecasts indicate that by the 2025, US 70 could carry between 2,400 to 13,000 vehicles per day. To adequately handle future traffic volumes, it is recommended that US 70 should be widened to a multilane facility, cross section F, from Rutherford College Urban Planning Boundary to the Hickory Urban Planning Boundary. The other section of US 70 is adequate for the study period and no improvements are recommended at this time. It is possible that an increase in residential development in the Lake James area may effect travel patterns, for this reason Burke County should protect this roadway through subdivision regulations and building set backs.

NC 181 - This route, that traverses the northern part of Burke County, provides access to Pisgah National Forest and a number of camp sites. The facility is designated as a bicycle route and is part of the Mountain to the Sea and the Piedmont Spur routes. Because of the mountainous terrain of this facility, some concern about truck travel along this route and the need for more truck turn outs and runaway ramps were brought up during meetings. It is recommended that these issues should be studied more closely and the lengthening and widening of existing turn outs should be considered. Also, from the Morganton Planning Boundary to SR 1244, it is recommended that this section should be widened to additional lanes (cross section A).

NC 18 - Traffic forecasts for NC 18, southeast of Morganton from the Morganton Planning Boundary to the Catawba County line, shows daily volumes at or approaching capacity by the planning year. As development along this corridor continues to increase, changing the character of the roadway, a deterioration of this facility may occur more quickly. This increase will be due primarily to increased residential growth in this area with some commercial growth near Morganton. It is recommended that NC 18 be widened to four lanes with some five lane sections in commercial areas as needed.

Major Collectors

The rural collector routes serve primarily intracounty travel. The major collectors roads supplement the arterial system by providing an interconnecting network between smaller population centers and the arterial system.

NC 183 - This route, located in the northern portion of Burke County, connects NC 181 to US 221. NC 183 has two 2.74 m (9-foot) lanes, and has average daily traffic volumes ranging from 500 to 1,100 vehicles per day in 1994. Traffic projections for the planning year (2025) indicates that traffic on this facility will increase to 1,800 vpd. These volumes can be accommodated by the existing facility but to improve safety and operations, it is recommended that this roadway be widened to provide a minimum 7.32 m (24 ft) cross section (Appendix C, cross section K).

NC 126 - This 2-lane roadway provides access to the Lake James Area in Burke County. With potential increased residential and recreational development along the lake the facility type and character could change during the planning period. NC 126 has two 2.74 m (9-foot) lanes, and carries less than 2,000 vehicles per day. Future traffic projection for the planning year (2025) range from 700 to 2,500 vpd. To improve safety and operations, it is recommended that this roadway be widened to provide a minimum 7.32 m (24-foot) cross section. In addition this route should be looked at to determine if bike accommodations are needed. With the lake and the natural beauty of the area this seems like a perfect environment for bicycling. There are signs posted to share the road with bicycles but a paved shoulder should be considered with the proposed widening of NC 126 to the minimum standard cross section (Appendix C, cross section O).

SR 1001 - The section of SR 1001 (Malcolm Boulevard) between the northern planning boundary of Rutherford College and the Caldwell County Line currently carries approximately 6,500 vehicles per day. The design and character of this roadway suggests that to maintain an acceptable level of traffic service, vehicles per day should not exceed 9,500. The future traffic projections of over 11,000 vehicles per day on this facility can not be accommodated safely and SR 1001 should be widened to a five lane curb an gutter section. (cross section C).

The Northeast Burke County Corridor - The following roads will be utilized as part of the Northeast Burke County Corridor: Lovelady Road, Rhodhiss Road, Oak Ridge Church Road, Hickory Airport Road and 9th Avenue (SR 1546, SR 1611, SR 1614, SR 1653 and SR 1625). This recommendation along with the funded NCDOT Transportation Improvement Program (TIP) Project #R-2824, the Lovelady Road Extension, will give Burke County a continuous northern route that would connect the Valdese, Rutherford College area to Hickory and the Hickory Airport. With the improvements and extension of Lovelady Road this set of connection facilities, SR 1611, 1614, and 1653, will also need to be upgraded to a 7.32 m (24-foot) cross-sections. This improvement has already been identified in the NCDOT Transportation Improvement Program as a future needs project (TIP #R-2920).

Bicycle Section

This section is dedicated to addressing the bicycle needs of Burke County. Burke County has two designated bicycle routes: the Mountains to Sea, NC Bike Route 2, and the Piedmont Spur, NC Bike Route 6. Because of this designation, these facilities may be subjected to more bicycle traffic than other facilities of similar design. Due to this shared, or multi-modal, use of these facilities, it is recommended that sub-standard sections be widened to a standard 24-foot cross section with 2-foot paved shoulders. These improvements will enhance safety and the functional design of the facility.

The following facilities are part of designated bicycle routes in Burke County and have sub-standard widths.

SR 1405 (Brown Mountain Beach Road): From Caldwell County to NC 181.
SR 1924 (Old NC 18): From Cleveland County to Morganton Planning Boundary.
NC 183 : From NC 181 to US 221.

NC 126 is another route that should be considered a bicycle route in Burke County. This route is not designated as a State bike route but because of the scenic and natural beauty of the Lake James area, NC 126 is used by bicyclists in the area. Because of the sub-standard width of NC 126, it's recommended that this route be widened to a standard cross section for bicycles (cross section O).

When considering the widening of these facilities, it is recommended that the Office of Bicycle and Pedestrian Transportation (NCDOT) be consulted. They can help provide the most appropriate cross section for the widening. They may also provide assistance in identifying the need for bicycle improvements based on present and future bicycle traffic. The County should contact the coordinator of this branch for further consideration and assistance.

Bicycle and Pedestrian Program
NC Department of Transportation
P.O. Box 25201
Raleigh, NC 27611

Public Involvement

The Burke County Thoroughfare Plan was officially started in February of 1995 by a meeting with the County Planning staff, and a presentation to the Burke County Planning Board. On April 25, 1995, preliminary findings were presented to the Planning Board with members of the public present. Upon recommendation of the Planning Board, these findings were presented to the Burke County Commissioners at the Public Hearing for the Thoroughfare Plan on September 19, 1995. Members of the public were present, but no one gave public comment on the Plan. At the close of the Public Hearing, the County Commissioners moved to adopt the Burke County Thoroughfare Plan. This Plan was adopted by the North Carolina Board of Transportation on February 2, 1996.

Chapter 3

Implementation of the Thoroughfare Plan

Once the thoroughfare plan has been developed and adopted, implementation is one of the most important aspects of the transportation plan. Unless implementation is an integral part of this process, the effort and expense associated with developing the plan is lost. There are several tools available for use by the County to assist in the implementation of the thoroughfare plan. They are described in detail in this Chapter.

State-County Adoption of the Thoroughfare Plan

Burke County and the North Carolina Department of Transportation (NCDOT) have mutually approve the thoroughfare plan shown in Figure 1. The mutually approved plan now serves as a guide for the Department of Transportation in the development of the road and highway system for the County. The approval of this plan by the County also enables standard road regulations and land use controls to be used effectively in the implementation of this plan.

Subdivision Controls

Subdivision regulations require every subdivider to submit to the County Planning Board a plan of any proposed subdivision. It also requires that subdivisions be constructed to meet certain standards. Through this process, it is possible to require the subdivision streets to conform to the thoroughfare plan and to reserve or protect necessary right-of-way for projected roads and highways that are to become a part of the thoroughfare plan. The construction of subdivision streets to adequate standards reduces maintenance costs and simplifies the transfer of streets to the State Highway System. Appendix D outlines the recommended subdivision design standards as they pertain to road construction.

Land Use Controls

Land use regulations are an important tool in that they regulate future land development and minimize undesirable development along roads and highways. The land use regulatory system can improve highway safety by requiring sufficient setbacks to provide for adequate sight distances and by requiring off-street parking.

Development Reviews

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the NCDOT. In addition, any development expected to generate large volumes of traffic (e.g., shopping centers, fast food restaurants, or large industries) may be comprehensively studied by staff from the Traffic Engineering Branch, Planning and Environmental Branch, and/or Roadway Design Unit of NCDOT. If done at an early stage, it is often possible to significantly improve the development's accessibility while preserving the integrity of the thoroughfare plan.

Funding Sources

County Construction Account

Nearly all secondary road work is done on a county by county basis. These funds are used to pave unimproved roads, widen roadways, stabilize dirt roads, make minor alignment improvements, and even construct short connectors when appropriate. The County Commissioners are encouraged to work with the Division Engineer when the County's priority list is developed. Many of the minor improvements recommended may be realized by using the County's construction account funds and cooperatively developing the County's priority list with the Division Engineer.

Transportation Improvement Program

North Carolina's Transportation Improvement Program (TIP) is a document which lists all major construction projects the Department of Transportation plans for the next seven years. Similar to local Capital Improvement Program projects, TIP projects are matched with projected funding sources. Each year when the TIP is updated, completed projects are removed, programed projects are advanced, and new projects are added.

During annual TIP public hearings, municipalities request projects to be included in the TIP. A Board of Transportation member reviews all of the project requests in a particular area of the state. Based on the technical feasibility, need, and available funding, the board member decides which projects will be included in the TIP. In addition to highway construction and widening, TIP funds are available for bridge replacement, highway safety, public transit, railroad crossings, and bicycle facilities.

Industrial Access Funds

If an Industry wishes to develop property that does not have access to a state maintained highway and certain economic conditions are met, then funds may be made available for construction of an access road.

Small Urban Funds

Small Urban funds are annual discretionary funds made to municipalities with qualifying projects. The maximum amount is $1,000,000 per year per division. A town may have multiple projects. Requests for Small Urban Fund assistance should be directed to the appropriate Board of Transportation member and Division Engineer.

The North Carolina Highway Trust Fund Law

The Highway Trust Fund Law was established in 1989 as a plan with four major goals for North Carolina's roads and highways. These goals are:

1. To complete the remaining 1,716 miles (2.768 km) of four lane construction on the 3,600 mile (5.806 km) North Carolina Intrastate System.

2. To construct a multilane connector in Asheville and portions of multilane loops in Charlotte, Durham, Greensboro, Raleigh, Wilmington, and Winston-Salem.

3. To supplement the secondary roads appropriation in order to pave, by 1999, 10,000 miles (16,129 km) of unpaved secondary roads carrying 50 or more vehicles per day, and all other unpaved secondary roads by 2006.

4. To supplement the Powell Bill Program.

The portion of this bill which will benefit Burke County, over the thirty year planning period, is the paving of most, if not all, of its unpaved roads on the State maintained system. For more information on the Highway Trust Fund Law, contact the Program Development Branch of the North Carolina Department to Transportation.

Implementation Recommendations

The following table provides a break down of the projects recommended in the Burke County Thoroughfare Plan and the corresponding method that would best suit the implementation of the given project.

Table 1

Funding Sources and Methods Recommended for Implementation of Projects

	Funding Sources				Methods of Implementation			
Projects	Local Funds	TIP Funds	Indust. Access	Small Urban	T-fare Plan	Subdiv. Ord.	Zoning Ord.	Development Review
US 64/NC 18		X			X			X
US 64		X			X			X
US 70		X			X	X	X	X
SR 1001		X			X			X
NC 181		X			X			X
NC 18		X			X			X

Construction Priorities and Cost Estimates

Construction priorities vary depending on what criteria are considered and what weight is attached to the various criteria. Most people would agree that improvements to the major thoroughfare system and major traffic routes would be more important that minor thoroughfares where traffic volumes are lower. To be in the North Carolina Transportation Improvement Program, a project must show favorable benefits relative to costs and should not be prohibitively disruptive to the environment. The potential cost estimate of the Burke County projects with respect to the user benefits, and the probabilities that economic development will be stimulated and environmental impacts will be minimized are given in Table 3.

Table 2

Probability Estimation Guide

Subjective Evaluation	Impact Probability
Excellent - very substantial	1.00
Very good - substantial	0.75
Good -considerable	0.50
Fair - some	0.25
Poor - none	0.00

Reduced road user cost should result from any roadway improvement, from a simple widening to the construction of a new roadway to relieve congested or unsafe conditions. Comparisons of the existing and the proposed facilities have been made in terms of vehicle operating costs, travel time costs, and accident costs. These user benefits are computed as total dollar savings over the 30 year design period using data such as project length, base year and design year traffic volumes, traffic speed, type of facility, and volume/capacity ratio.

The impact of a project on economic development potential is shown as the probability that it will stimulate the economic development of an area by providing access to developable land and reducing transportation costs. It is a subjective estimate based on the knowledge of the proposed project, local development characteristics, and land development potential. The probability is rated on a scale from 0 (representing no development potential) to 1.00 (representing excellent development potential).

The environmental impact analysis considers the effect of a project on the physical, social/cultural, and economic environment. Below is a list of the thirteen items that are considered when evaluating the impacts on the environment:

* air quality
* water resources
* soils and geology
* wildlife
* vegetation
* neighborhoods
* noise
* educational facilities
* churches
* parks and recreational facilities
* historic sites and landmarks
* public health and safety
* aesthetics

The environmental impact analysis also uses a probability rating from 0 (representing no benefit to the environment) to 1.00 (representing a positive impact to the environment). A negative value is assigned to the probability to indicate a negative impact. The summation of both positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impacts of a project. Table 2 shows the probability scale used in the analysis. This table can be used as a guideline for interpreting the "Economic Development" and "Environmental Impact" values given in Table 3.

Table 3

Benefits Evaluation for Major Projects

Projects	Benefits (millions)	Costs (millions)	Length (km)	Benefits/ km	Economic Develpmnt.	Envirn. Impact
US 64/NC 18	31.6	16.6	12.9	2.45	0.63	0.62
US 64	25.6	16.8	14.1	1.82	0.63	0.46
US 70	12.4	5.09	4.00	3.09	0.75	0.38
SR 1001	3.03	1.82	1.46	2.07	0.30	0.46
NC 181	5.24	3.34	3.38	1.55	0.63	0.31
NC 18	19.5	18.1	17.2	1.13	0.63	0.46

Offsetting the benefits that would be derived from any project is the cost of its construction. A new facility, despite its high projected benefits, might prove to be unjustified due to the excessive costs involved in construction. The highway costs estimated in this report are based on the average statewide construction costs for similar project types. The anticipated right-of-way costs is also included as an average cost per acre for property throughout Burke County according to the respective project. Table 4 provides a break down of total project cost into construction cost and right-of-way cost for the major project proposals for the Thoroughfare Plan.

Table 4

Potential Project Cost Estimates for Major Projects

Project Description	Construction Cost	Right-of-way Cost	Total Cost
US 64/NC 18 widening	$16,000,000	$600,000	$16,600,000
US 64 widening	$16,190,000	$590,000	$16,780,000
US 70 widening	$4,820,000	$280,000	$5,100,000
SR 1001 widening	$1,760,000	$64,000	$1,820,000
NC 181 widening	$3,104,000	$196,000	$3,300,000
NC 18 widening	$17,000,000	$1,000,000	$18,100,000

Chapter 4

Analysis of Burke County's Roadway System

This chapter presents an analysis of the ability of the existing street system to serve the area's travel desires. Emphasis is placed not only on detecting the deficiencies, but on understanding their cause. Travel deficiencies may be localized and the result of substandard highway design, inadequate pavement width, or intersection controls. Alternately, the underlying problem may be caused by a system deficiency such as a need for a bypass, loop facility, construction of missing links, or additional radials.

An analysis of the roadway system must first look at existing travel patterns and identify existing deficiencies. This includes roadway capacity and safety analysis. After the existing picture of travel in the area has been developed, the engineer must analyze factors that will impact the future system. These factors include forecasted population growth, economic development potential, and land use trends. This information will be used to determine future deficiencies in the transportation system.

Current Transportation Plans for Burke County

Thoroughfare Plans

Thoroughfare plans are a tool to aid officials in the development of an appropriate transportation system. It is important that the communities within a County, and the County officials cooperate as a team in the development of their transportation system. Plan development and implementation jointly undertaken will help ensure the development of an efficient system for travel throughout the County. The following thoroughfare planning studies have previously been done for Burke County:

1. Morganton*, plan adopted in 1987
2. Hickory*, plan adopted in 1992
3. Valdese*, plan adopted in 1978
4. Drexel, plan adopted in 1984
5. Rutherford College, no previous plan.

***Thoroughfare plan currently under study**

Transportation Improvement Program Projects

As covered in Chapter 3, the Transportation Improvement Program (TIP) is a seven year project planning document that lists the major transportation improvement projects that the Department of Transportation has planned. These projects include not only roadway projects, but also bridge projects, railroad crossings, bicycle facilities, and public transportation. Burke County has several roadway projects identified in the 1996-2002 TIP, these projects are listed below:

1. I-40, SR 1129 (Exit 95) to west of NC 114 (Exit 107). Pavement rehabilitation.

2. I-40, East of US 221 (Exit 85) to SR 1129 (Exit 94) pavement rehabilitation. (Includes part of I-602 E)

3. I-40, West of NC 114 (Exit 107) to SR 1002 (Exit 119). Pavement rehabilitation.

4. I-40, SR 1002 (Exit 119) in Burke County to NC 16 (Exit 131) in Catawba County. Pavement rehabilitation, bridge and safety improvements.

5. US 64-NC 18, Multi-lanes north of Morganton to Multi-lanes in Gamewell. Widen roadway to a multi-lane facility.

6. SR 1001, Southern Railway, Construct railroad grade separation at rail crossing 729 520c.

7. SR 1546, SR 1545 (Laurel Street) to SR 1608 (Shady Grove Road). Widen roadway and extend, part on new location.

8. New Route, Northeast Burke County Corridor, upgrade SR 1611, SR 1614, SR 1653 and widen SR 1625 to multi-lanes with some relocation.

9. Glen Alpine, Construct a connector on new location from SR 1147 (Causby Road) to US 70.

10. Hickory/Longview, Northwest Loop, 33rd Street at I-40 to Airport Road at US 321. Multi-lane improvements, connector on new location and a new interchange at SR 1124 and I-40.

11. Morganton, NC 18, US 70 Bypass (Fleming Drive) to I-40. Widen roadway to a five lane curb and gutter facility.

12. Morganton, SR 1922-SR 1924, I-40 to NC 18. widen roadway to a multi-lane facility.

13. Morganton, Stonebridge Drive Extension, NC 18 (South Sterling Street) to US 70 Bypass. Construct a connector part on new location.

Existing Travel Pattern and Deficiencies

Traffic Demand

Travel demand is generally reported in average daily traffic counts. Traffic counts are taken regularly in several locations within Burke County by the North Carolina Department of Transportation. The 1995 average daily traffic counts for Burke County are shown in Figure 3.

Width and Alignment Deficiencies

North Carolina's standard for highway construction calls for 11-foot (3.35m) lanes on all highways with traffic volumes greater than 2,000 ADT (Average Daily Traffic) or design speeds greater than 50 miles per hour. This includes all primary arterials. A 9-foot (2.74m) minimum lane width can be tolerated on collector roads with an ADT of less than 4,300 vehicles per day. The minimum level of service for minor collector roads dictates a 40 mph design speed during peak traffic conditions. These standards are summarized below in Table 5.

Table 5

Minimum Tolerable Lane Width

Average Daily Traffic	Principal Arterials		Minor Arterials		Collectors	
	feet	meters	feet	meters	feet	meters
over 2,000	11	3.35	11	3.35	11	3.35
400 - 2,000	---	-----	10	3.05	10	3.05
100 - 400	---	-----	10	3.05	9	2.74
below 100	---	-----	---	-----	9	2.74

There are a number of roadway in Burke County that have substandard widths. Because of the substantial cost of upgrading all secondary roads to standard (24' pavement), narrow widths may have to be tolerated until sufficient funds are available for improvements. The roads identified as a part of Burke County's Thoroughfare Plan study that have substandard widths are listed below:

* **SR 1803:** SR 1800 - Hickory Urban Planning Boundary. (UPB)
* **SR 1423:** US 64/NC 18 - SR 1439
* **SR 1439:** NC 181 - SR 1423
* **SR 1405:** NC 181 - Caldwell Co
* **SR 1410:** NC 181 - SR 1439
* **SR 1512:** Morganton UPB - SR 1544
* **SR 1618:** Hickory UPB -SR 1611
* **SR 1956:** Morganton UPB - SR 1965
* **SR 1922:** Enola - Morganton UPB
* **SR 1924:** Morganton UPB - Cleveland Co
* **SR 1907:** NC 18 - SR 1924
* **SR 1913:** NC 18 - SR 1924
* **SR 1233:** US 70 - NC 126
* **SR 1129:** SR 1131 - US 70
* **SR 1786:** NC 18 - Hickory UPB
* **SR 1501:** SR 1512 - US 64
* **SR 1001:** NC 18 - Valdese UPB

Capacity Analysis of the Existing System

An indication of the adequacy of the existing street system is a comparison of traffic volumes versus the ability of the streets to move traffic freely at a desirable speed. The ability of a street to move traffic freely, safely, and efficiently with a minimum delay is controlled primarily by the spacing of major devices utilized. Thus, the ability of a street to move traffic can be increased by restricting parking and turning movements, using proper sign and signal devices, and by the application of other traffic engineering strategies.

Capacity is the maximum rate at which vehicles can reasonably be expected to traverse a given section of a roadway during a given period under prevailing roadway and traffic conditions (Highway Capacity Manual, Special Report 209, 1-4, 1994). Roadway capacities and 1995 average daily traffic for minor arterials in Burke County are shown in Figure 3. There is currently no facility in Burke County that is over capacity.

The relationship of traffic volumes to the capacity of the roadway will determine the level of service (LOS) being provided. Six levels of service have been selected for analysis purposes. They are given letter designations from A to F with LOS A representing the best operating conditions and LOS F the worst.

The six levels of service are illustrated in Figure 4, and they are defined on the following pages. The definitions are general and conceptual in nature, but may be applied to urban arterial levels of service. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them. The 1994 Highway Capacity Manual contains more detailed descriptions of the levels of service as defined for each facility type.

1995 TRAFFIC WITH EXISTING ROADWAY CAPACITIES

LEGEND

1995 ADT
ROADWAY CAPACITY — 3290 / 5974

URBAN THOROUGHFARE
PLANNING BOUNDARY

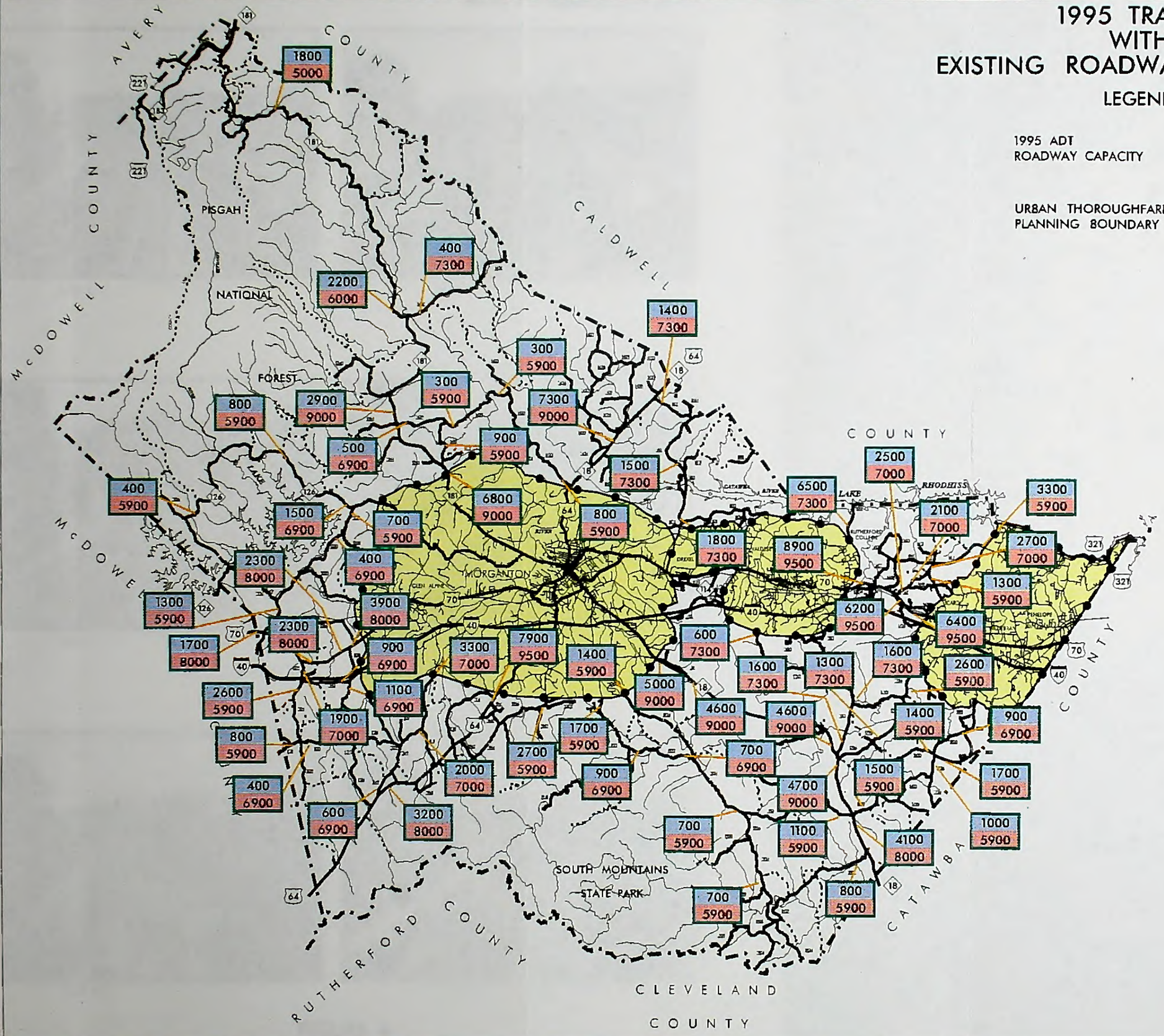

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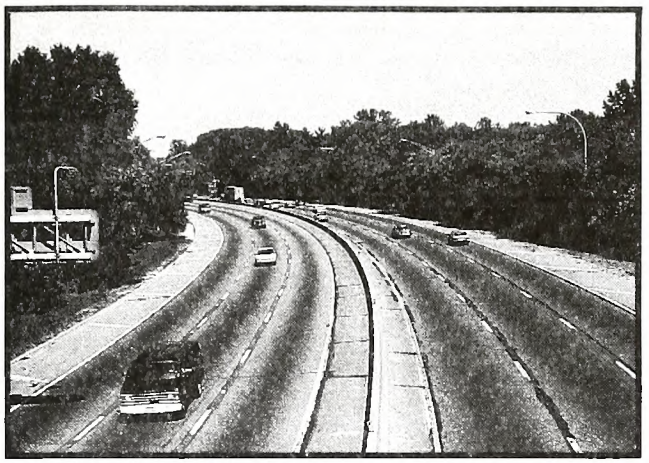
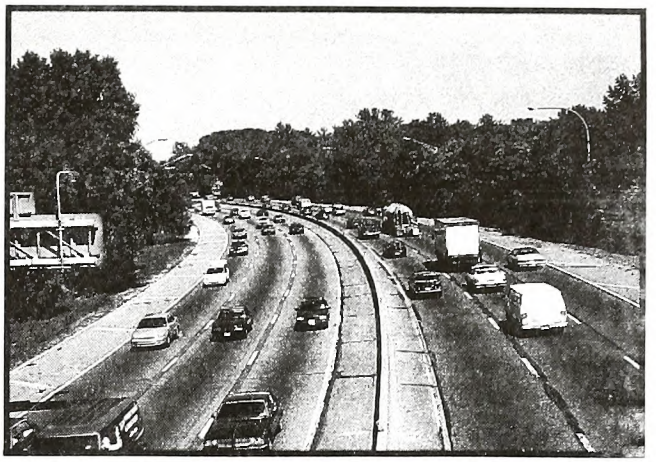
FIGURE 3

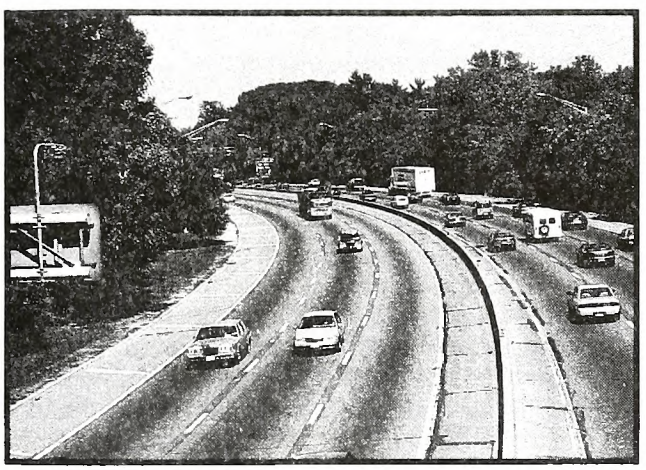
Source: 1994 Highway Capacity Manual



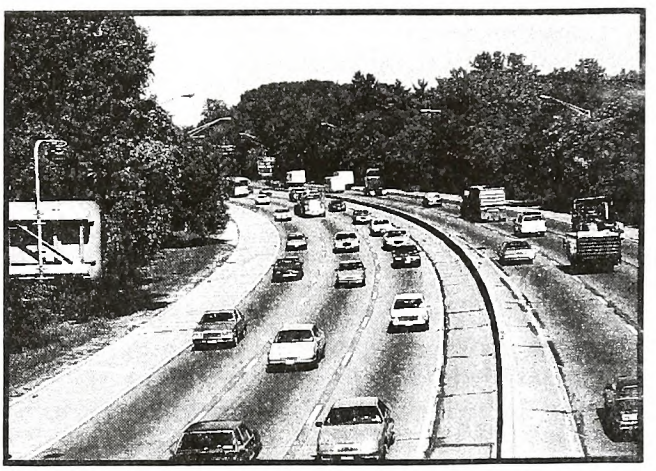
LOS A.



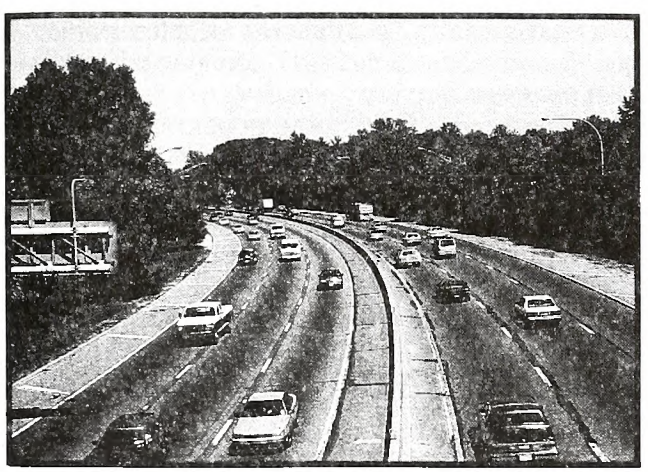
LOS D.



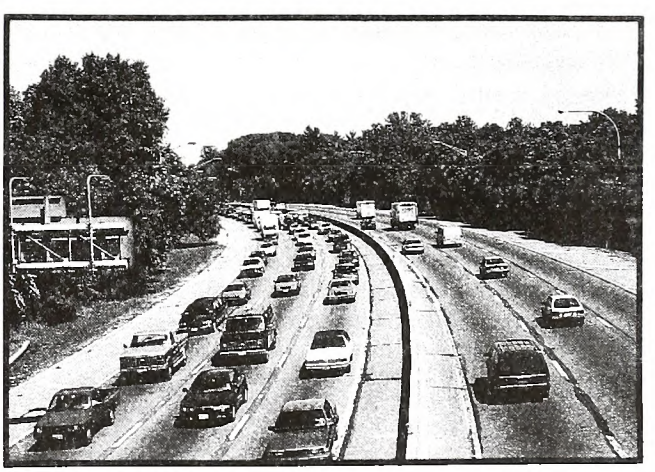
LOS B.



LOS E.



LOS C.



LOS F.

FIGURE 4

LEVELS OF SERVICE

Level of Service

LOS A

Describes primarily free flow conditions. The motorist experiences a high level of physical and psychological comfort. The effects of minor incidents or breakdowns are easily absorbed. Even at the maximum density, the average spacing between vehicles is about 528 ft, or 26 car lengths.

LOS B

Represents reasonably free flow conditions. The ability to maneuver within the traffic stream is only slightly restricted. The lowest average spacing between vehicles is about 330 ft, or 18 car length.

LOS C

Provides for stable operations, but flows approach the range in which small increases will cause substantial deterioration in service. Freedom to maneuver is noticeably restricted. Minor incidents may still be absorbed, but the local decline in service will be great. Queues may be expected to form behind any significant blockage. Minimum average spacings are in the range of 220 ft, or 11 car lengths.

LOS D

Borders on unstable flow. Density begins to deteriorate somewhat more quickly with increasing flow. Small increases in flow can cause substantial deterioration in service. Freedom to maneuver is severely limited, and the driver experiences drastically reduced comfort levels. Minor incidents can be expected to create substantial queuing. At the limit, vehicles are spaced at about 165 ft, or nine car lengths.

LOS E

Describes operation at **capacity.** Operations at this level are extremely unstable, because there are virtually no usable gaps in the traffic stream. Any disruption to the traffic stream, such as a vehicle entering from a ramp, or changing lanes, requires the following vehicles to give way to admit the vehicle. This can establishes a disruption wave that propagates through the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate any disruption. Any incident can be expected to produce a serious breakdown with extensive queuing. Vehicles are spaced at approximately six car lengths, leaving little room to maneuver.

LOS F

Describes forced or breakdown flow. Such conditions generally exist within queues forming behind breakdown points.

Traffic Accidents

Traffic accident are often used as an indicator for locating congestion problems. Traffic accident records can also be reviewed to identify problem locations or deficiencies such as poor design, inadequate signing, ineffective parking, or poor sight distance. Accident patterns developed from analysis of accident data can lead to improvements that will reduce the number of accidents.

Table 6 is a summary of the accidents occurring in Burke County between June 1992 and May 1995. This table only includes locations with 10 or more accidents. The "Total" column indicates the total number of accidents reported within 200 ft (61.0 m) of the intersection during the study period indicated. The severity listed is the average accident severity for that location.

Table 6

Location with 10 or More Accidents in a 3-Year Period

Locations	Angle	Rear End	Ran Off Road	Left Turn	Right Turn	Other	Total	Severity
US 70/NC 114	7	1	1	9	2	3	29	3.81
US 70/SR 1525	3	1	4	8	1	1	17	7.20

Both the severity and number of accidents should be considered when investigating accident data. The severity of every accident is measured with a series of weighting factors developed by NCDOT's Division of Highways. In terms of these factors, a fatal or incapacitating accident is 47.7 times more severe than one involving only property damage, and an accident resulting in minor injury is 11.8 times more severe than one with only property damage. To request a more detailed accident analysis for any of the above mentioned intersection, or other intersections of concern, the County should contact the Division 13 Traffic Engineer.

Existing Bridge Conditions

Bridges are a vital and unique element of a highway system. First, they represent the highest unit investment of all elements of the system. Second, any inadequacy or deficiency in a bridge reduces the value of the total investment. Third, a bridge presents the greatest opportunity of all potential highway failures for disruption of community welfare. Finally, and most importantly, a bridge represents the greatest opportunity of all highway failures for loss of life. For these reasons, it is imperative that bridges be constructed to the same design standards as the system of which they are a part.

Congress enacted the National Bridge Inspection Program Standards on April 27, 1971, implementing the Federal Highway Act of 1968. These standards require that "all structures designed as bridges located on any of the Federal-Aid Highway Systems be inspected and the safe load carrying capacity computed at regular intervals, not to exceed two years." A sufficiency index number has been calculated for each bridge to establish eligibility and priority for replacement. The bridges with the highest priority are replaced as Federal-Aid fund and State funds become available.

The North Carolina DOT's Bridge Maintenance Unit, with assistance from various consultants, inspect all bridges on the State Highway System. All bridges in Burke County have been analyzed, rated, and inventoried. The resulting data has been reduced to a more readily usable form as a management tool.

A sufficiency rating was used in the analysis to determine the deficiency of each bridge. The sufficiency rating is a method of evaluating factors that determine whether a bridge is sufficient to remain in service. Factors used include:

* structural adequacy and safety
* serviceability and functional obsolescence
* essentiality for public use
* type of structure
* traffic safety features

The result of this method is a percentage in which 100 percent represents an entirely sufficient bridge and zero percent represents an entirely insufficient or deficient bridge. A sufficiency rating of 50 percent or less qualifies for Federal Bridge Replacement Funds.

Deficient bridges are categorized as either functionally obsolete or structurally deficient. Bridges in the functionally obsolete category have below average ratings in approach roadway alignment, under clearance, deck geometry, waterway adequacy, or structural condition. Structurally deficient bridges have below average ratings in deck superstructure, substructure, overall structural condition, or waterway adequacy. Table 7 shows the functionally obsolete bridges in Burke County. Table 8 shows the ten most structurally deficient bridges in Burke County.

Table 7

Functionally Obsolete Bridges in Burke County (ratings<50.0)

Bridge Number	Facility Carried	Location	Rating
16*	SR 1795	0.8 mi S of SR 1001	37.9
61	SR 1439	0.9 mi E of SR 1410	49.5
70	SR 1918	0.3 mi W of SR 1922	49.5
79	SR 1956	0.5 mi W of SR 1957	47.8
145	SR 1430	0.05 mi N of SR 1431	48.3
216	SR 1722	0.02 mi S of SR 1731	47.1
217	SR 1731	0.15 mi E of SR 1722	47.1
237	SR 1913	0.1 mi E of SR 1914	46.7
273	SR 1421	0.15 mi S of SR 1419	49.9
347	SR 1984	0.01 mi W of NC 18	36.8

Note * - Denotes the Bridge is in the current Transportation Improvement Program

Table 8

Ten Most Structurally Deficient Bridges in Burke County

Bridge Number	Facility Carried	Location	Rating
83*	SR 1149	0.02 mi N of SR 1113	12.0
102*	SR 1438	0.35 mi E of SR 1424	15.0
86	SR 1147	0.05 mi S of SR 1148	15.8
215	SR 1949	0.3 mi E of US 64	21.5
292	SR 1001	0.8 mi N of NC 18	21.8
108	SR 1740	0.3 mi E of SR 1739	28.1
171	SR 1761	0.1 mi E of SR 1770	28.9
148	SR 1547	0.2 mi E of SR 1549	30.0
210*	SR 1647	0.3 mi S of SR 1655	31.9
80	US 64 & NC 18	0.1 mi S of SR 1593	32.1

Note * - Denotes the Bridge is in the current Transportation Improvement Program

Factors Affecting the Future Roadway System

The objective of thoroughfare planning is to develop a transportation system that will meet future travel demand and enable people and goods to travel safely and economically. To determine the needs of an area it is important to understand the role of population, economics, and land use have on the highway system. Examination of these factors helps to explain historic travel patterns and lays the groundwork for thoroughfare planning.

Population

The amount of traffic on a section of roadway is a function of the size and location of the population which it serves. Investigating past trends in population growth and forecasting future population growth and dispersion is one of the first steps for a transportation planner. Table 9 shows the historical and projected population trends for Burke County through 2025. Table 10 shows population trends for the townships in Burke County.

Table 9

Burke County Population Forecasts

Year	Population	Percent Change
1970	60,364	
1980	72,504	+20.1
1990	75,744	+4.5
1995	78,449a	+3.6
2000	79,398a	+1.2
2010	79,662a	+0.3
2020	79,209a	-0.6
2025	78,971b	-0.3

Note: a - Estimate by Office State Budget and Management
b - Projection based on past trends

Table 10

Burke County Population by Township

Township	1970	1980	1990	1980-1990
Drexel	4,563	5,143	6,131	+988 / +19.2%
Icard	11,040	13,791	14,060	+269 / +2.0%
Jonas Ridge	488	765	659	-106 / -13.9%
Linville	1,078	1,422	1,131	-291 / -20.5%
Lovelady	6,630	8,083	8,005	-78 / -1.0%
Lower Creek	1,389	1,957	2,079	+122 / +6.2%
Lower Fork	1,722	1,896	2,364	+468 / +24.7%
Morganton	22,389	24,072	24,730	+658 / +2.7%
Quaker Meadow	3,500	5,237	5,827	+590 / +11.3%
Silver Creek	5,555	8,008	8,228	+220 / +2.8%
Smoky Creek	442	471	665	+194 / +41.2%
Upper Creek	753	811	1,014	+203 / +25.0%
Upper Fork	815	848	851	+3 / +0.4%

Economy and Employment

One of the more important factors to be considered in estimating the future traffic growth of an area is its economic base. The number of employers and the employee's income or purchasing power influences how much population can be supported in the area and the number of motor vehicles that will be locally owned and operated. Generally, as the family income increases so does the number of vehicles owned, as well as the number of vehicles trips generated per day by each household. An accurate projection of the future economy of the area is essential to estimating future travel demand.

Factors which will influence economic growth and development in Burke County over the 30 year planning period include the expansion of the Morganton and Hickory Urbanized Areas. Another area that could influence economic growth of Burke County in the future is the development of Lake James.

Land Use

Land use refers to the physical patterns of activities and functions within a city or county. Nearly all traffic problems in a given area can attributed in some form to the type of land use. For example, a large industrial plant might be the cause of congestion during shift change hours as its workers come and go. However, during the remainder of the day few problems, if any, may occur. The spatial distribution of different types of land use is the predominant determinant of when, where, and why congestion occurs. The attraction between different land uses and their association with travel varies depending on the size, type, intensity, and spatial separation of each.

For use in transportation planning, land uses are grouped into four categories:

1. Residential - all land devoted to the housing of people (excludes hotels and motels)

2. Commercial - all land devoted to retail trade including consumer and business services and offices

3. Industrial - all land devoted to manufacturing, storage, warehousing, and transportation of products

4. Public -all land devoted to social, religious, educational, cultural, and political activities.

Figure 5 shows the planning area's existing land use.

Anticipated future land use is a logical extension of the present spatial distribution. Determination of where expected growth is to occur within the planning area facilitates the location of proposed thoroughfares or the improvements of existing thoroughfares. Areas of anticipated development and growth for Burke County are:

1. Residential - eastern, central

2. Commercial/Retail - eastern, central

3. Industrial - western, central

4. Public - continued preservation of the Pisgah National Forest, South Mountain State Park and the Lake James Area

The central and eastern portions of the planning area have the largest growth expectations. These areas are served by five major routes - I-40, US 64 & NC 18, US 64, US 70 and NC 181. The slowest growth is expected to occur in the northwest and south portions of the County. This slow growth is attributed primarily to the environmentally sensitive areas around Pisgah National Forest, as well as the South Mountain State Park.

EXISTING LAND USE

LEGEND

RESIDENTIAL

COMMERCIAL

INDUSTRIAL

PUBLIC/INSTITUTIONAL

URBAN THOROUGHFARE PLANNING BOUNDARY

AVERY COUNTY

McDOWELL COUNTY

CALDWELL COUNTY

PISGAH NATIONAL FOREST

MORGANTON

LAKE RHODHISS

CATAWBA COUNTY

RUTHERFORD COUNTY

SOUTH MOUNTAINS STATE PARK

CLEVELAND COUNTY

N

BURKE COUNTY

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FIGURE 5

Forecasted Travel Patterns and Deficiencies

Future Travel Demand

Future travel demand can be forecasted by looking at past traffic trends and calculating the average annual growth rates along any particular route. Using the past trends along with the projected land uses and the forecasted population growth, the transportation planner is able to forecast future travel demand and to predict where future problems may occur. For this study Average Daily Traffic (ADT) counts for the past thirty years were used in a linear regression analysis to estimate future ADT counts. Figure 6 and Table B-1 in Appendix B provides forecasted traffic for the major and minor thoroughfares in Burke County.

Capacity Deficient Corridors

Capacity deficient corridors were determined using the volume/capacity ratio (V/C), with the projected traffic over the practical capacity of the facility. A (V/C) ratio less then one is tolerable. Based on this analysis, several roadways in Burke County are anticipated to be inadequate by the planning year 2025. These routes are shown in red on Figure 6 and include:

- **US 64/NC 18**
- **US 64**
- **SR 1001**
- **US 70**
- **NC 181**

Traffic congestion on these routes can be alleviated by widening to increase traffic carrying ability. See Chapter 2 for recommendations.

Streets Approaching Capacity

Analysis indicates that NC 18 will be approaching capacity by the planning year 2025. This route is shown in green on Figure 7. Other roadways in the planning area are not expected to have congestion problems within the planning period. However, to improve safety and operating conditions, it is recommended that the roadways designated as either major or minor thoroughfares with lane widths less then 12-feet (3.66m) be upgraded to reflect this desired width.

System Deficiencies

System deficiencies result from a lack of a cohesive, continuous, and complimentary major street network. More simply put, a system deficiency exists when drivers must go out of their way to get from point A to point B, or when the path for getting there is not cohesive or continuous. The thoroughfare plan study has identified the routes SR 1613, SR 1614, and SR 1611 the Northeast Burke County Corridor as a system deficiency. A possible means for improving this facility is the construction of the Lovelady Road Extension along with minor improvements to the rest of the corridor. Other system deficiencies that were identified due to substandard design are shown in yellow in Figure 7.

Intersection Deficiencies

Problems with intersection design or control can contribute to poor movement of traffic, increased traffic accidents, and driver irritation. Most of the major traffic intersections within Burke County are located within the urban areas throughout the County. A major concern of the citizens of Burke County is the interchange facilities along I-40 in the urban areas. The problem is just noted here but these locations will be addressed in the individual studies for those areas.

FORECASTED 2025 TRAFFIC WITH EXISTING ROADWAY CAPACITIES

LEGEND

FORECASTED 2025 ADT
ROADWAY CAPACITY — 3290 / 5974

URBAN THOROUGHFARE PLANNING BOUNDARY

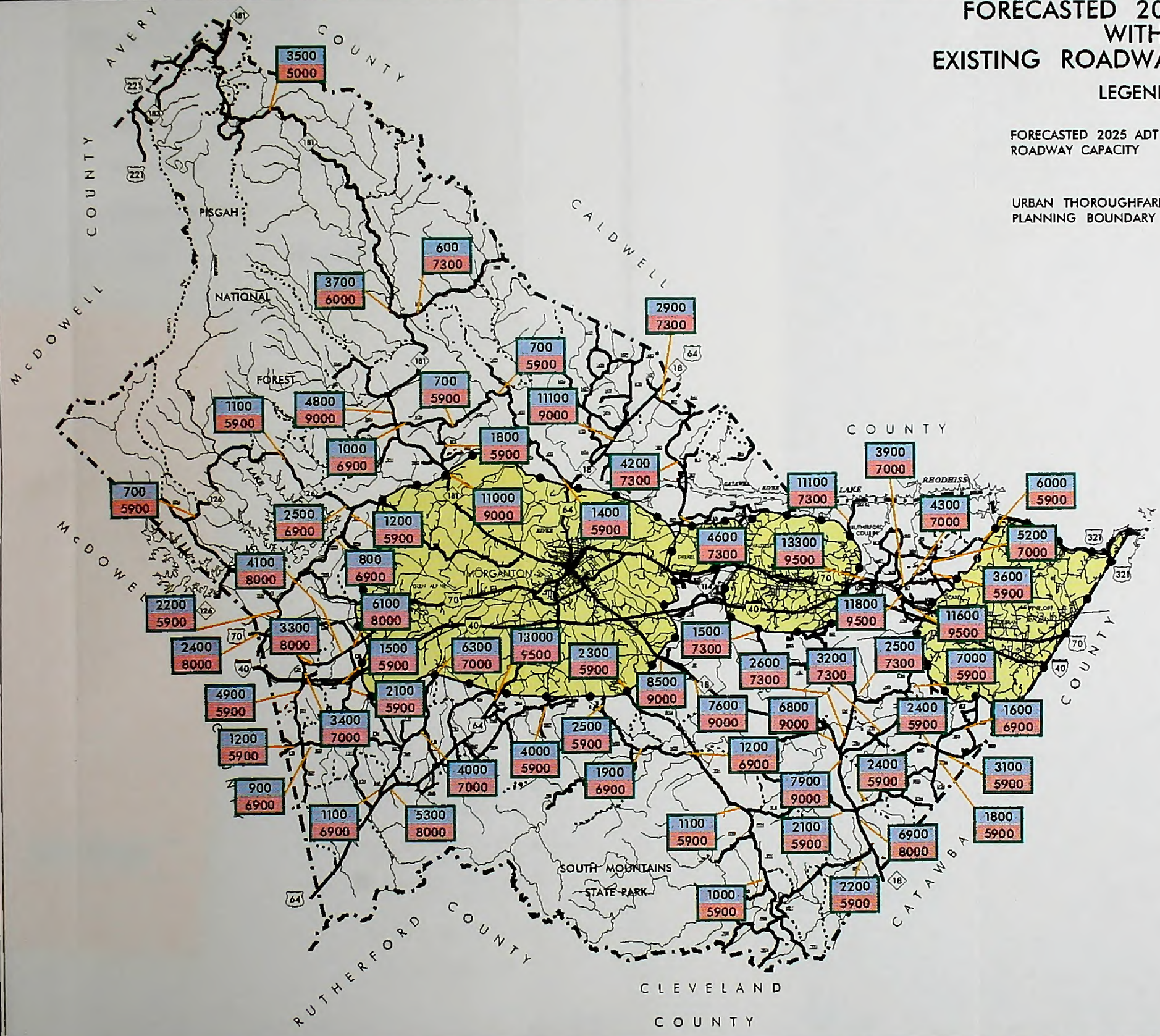

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FIGURE 6

ANTICIPATED ROADWAY DEFICIENCIES

LEGEND

- OVER CAPACITY
- NEAR CAPACITY
- SUBSTANDARD DESIGN
- TIP PROJECT
- URBAN THOROUGHFARE PLANNING BOUNDARY

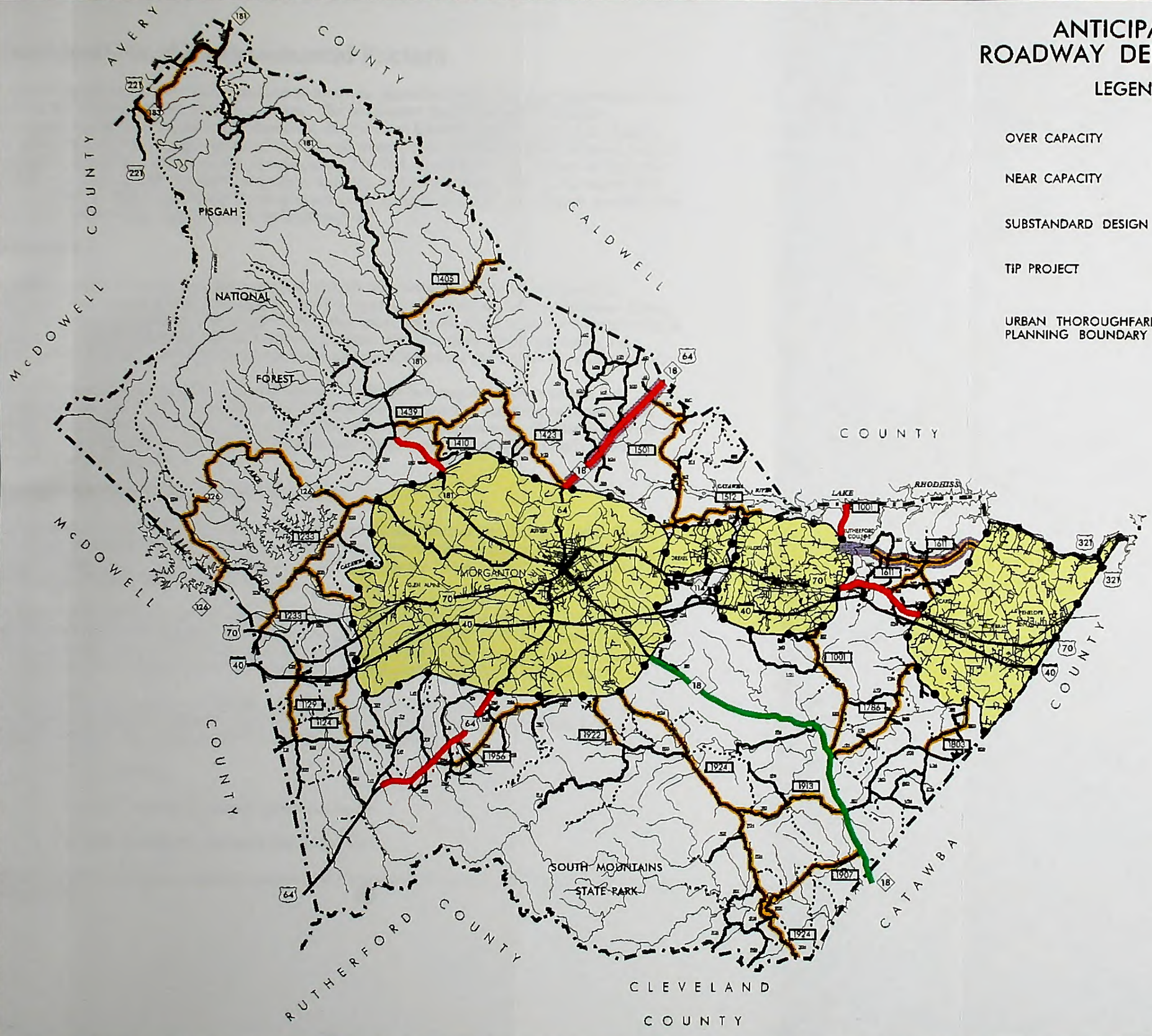

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FIGURE 7

Consideration of Environmental Factors

In the past several years, environmental considerations associated with highway construction have come to the forefront of the planning process. The legislation that dictates the necessary procedures regarding environmental impacts is the National Environmental Policy Act. Section 102 of this act requires the execution of an environmental impact statement (EIS) for road projects that have a significant impact on the environment. The EIS would cover the impact of the project of wetlands, water quality, historic properties, wildlife, and public lands. While this report does not cover the environmental concerns in as much detail as an EIS would, preliminary research was done on several of these factors and is included below.

Wetlands

In general terms, wetlands are lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water. Water creates severe physiological problems for all plants and animals except those that are adapted for life in it or in saturated soil.

Wetlands are crucial ecosystems in our environment. They help regulate and maintain the hydrology of our rivers, lakes and streams by slowly storing nutrients, reducing sediment loads, and reducing erosion. They are also critical to fish and wildlife populations. Wetlands provide an important habitat for about one third of the plant and animal species that are federally listed as threatened or endangered.

Threatened and Endangered Species

A preliminary review of the Federally Listed Threatened and Endangered Species within Burke County was done to determine the effects that any proposed improvements could have on these species. These species were identified using mapping from the North Carolina Department of Environment, Health, and Natural Resources.

The Threatened and Endangered Species Act of 1973 allows the U.S. Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a road project on endangered plant and animals and critical wildlife habitats. By locating rare species in the planning stage of road construction, we can avoid or minimize these impacts.

There were various sightings of rare plants and animals throughout Burke County, as well as several areas identified as priority areas for threatened or endangered species. Projects of particular concern with respect to rare plants and animals include:

1. NC 18 widening

2. NC 126 widening to standard pavement width

3. SR 1924 widening to standard pavement width

A detailed field investigation of these corridors is recommended prior to the construction of any of these projects.

Other Environmental Concerns

Wild Trout Waters

Throughout the State of North Carolina approximately 1,100 miles of high quality trout streams capable of sustaining trout populations by natural reproduction are designated as Wild Trout Waters. In Burke County there are three areas designated in having Trout Streams: Pisgah National Forest, South Mountains State Park, and Lake James. Projects of particular concern with respect to Trout Streams include:

1. NC 126 widening to standard pavement width

2. NC 183 widening to standard pavement width

3. NC 181 when considering lengthing and widening or new turn outs

A detailed field investigation of these corridors is recommended prior to the construction of any of these projects.

Historic Sites

The location of historic sites in Burke County were investigated to determine the possible impact of the various projects studied. The federal government has issued guidelines requiring all State Transportation Departments to make special efforts to preserve historic sites. In addition, the State of North Carolina has issued its own guidelines for the preservation of historic sites. These two pieces of legislation are described below:

National Historic Preservation Act - Section 106 of this act requires the Department of Transportation to identify historic properties listed in the National Register of Historic Places and properties eligible to be listed. The DOT must consider the impact of its road projects on these properties and consult with the Federal Advisory Council on Historic Preservation.

NC General Statute 121-12(a) - This statute requires the DOT to identify historic properties listed on the National Register, but not necessarily those eligible to be listed. DOT must consider impacts and consult with the North Carolina Historical Commission, but it is not bound by their recommendations.

The State Plan for Historic Preservation has several sites within Burke County. Most of these sites are located in the urban areas of Burke County. The James House located along US 64/NC 18 was identified as potentially eligible for the National Register of Historical Places. Also the Gilboa Methodist Church located on US 64 south of Morganton is listed on the National Register. All efforts will be made to minimize the impact to these sites when widening of US 64. The preliminary investigation done for Burke County shows that none of the other sites identified will be affected by the proposed improvements.

APPENDICES

Appendix A

Thoroughfare Planning Principles

There are many benefits to be gained from thoroughfare planning, but the main objective is to assure that the road system will be progressively developed to serve future travel desires adequately. Thus, the main consideration in thoroughfare planning is to make provisions for street and highway improvements so that, when the need arises, feasible opportunities to make improvements exist.

Benefits of Thoroughfare Planning

There are two major benefits derived from thoroughfare planning. First, each road or highway can be designed to perform a specific function and provide a specific level of service. This permits savings in right-of-way, construction, and maintenance costs. It also protects residential neighborhoods and encourages stability in travel and land use patterns. Second, local officials are informed of future improvements and can incorporate them into planning and policy decisions. This will permit developers to design subdivisions in a non-conflicting manner, direct school and park officials to better locate their facilities, and minimize the damage to property values and community appearance that is sometimes associated with roadway improvements.

County Thoroughfare Planning Concepts

The underlying notion of the thoroughfare plan is to provide a functional system of streets, roads, and highways that permit direct, efficient, and safe travel. Different elements in the system are designed to have specific functions and levels of service, thus minimizing the traffic and land service conflict.

In the county plan, elements are either urban or rural. In the urban planning area, the local municipality generally has planning jurisdiction. Outside the urban planning area, the county has planning jurisdiction. In those urban areas where no urban thoroughfare plan exists, elements are rural and are under the planning jurisdiction of the county.

Within the urban and rural systems, plan elements are classified according to the specific function they are to perform. A discussion of the elements and functions of the two systems follows.

Thoroughfare Classification Systems

Streets, roads, and highways perform two primary functions, traffic service and land service, but when combined, these two services are basically incompatible. This conflict is not serious if both traffic and land service demands are low. However, when traffic volumes are high, conflicts created by uncontrolled and intensely used abutting property create intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets that permit travel from origins to destinations with directness, ease and safety. Different streets in this system are designed and called on to perform specific functions, thus minimizing the traffic and land service conflict.

Urban Classification

In the urban thoroughfare plan, elements are classified as major thoroughfares, minor thoroughfares, or local access streets.

Major Thoroughfares

These routes are the primary traffic arteries of the urban area and they accommodate traffic movements within, around, and through the area.

Minor Thoroughfares

Roadways classified under this type collect traffic from the local access streets and carry it to the major thoroughfare system.

Local Access Streets

This classification covers streets that have a primary purpose of providing access to the abutting property. This classification may be further classified as either residential, commercial and/or industrial depending upon the type of land use that they serve.

Due to the limited amount of detail that can be shown on a county thoroughfare plan, only urban major thoroughfares are shown.

Rural Classification

The facilities outside the urban thoroughfare planning boundaries make up the rural system. There are four major systems: principal arterials, minor arterials, major and minor collectors, and local roads.

Rural Principal Arterial System

This system is a connected network of continuous routes that serve corridor movements having substantial statewide or interstate travel characteristics. This will be shown by both the trip lengths and the travel densities. The principal arterial system should serve all urban areas of over 50,000 population and most of those with a population greater than 5,000. The Interstate system constitutes a significant portion of the principal arterial system.

Rural Minor Arterial System

This system forms a network that links cities, larger towns, and other major traffic generators such as large resorts. The minor arterial system generally serves intrastate and intercounty travel and travel corridors with trip lengths and travel densities somewhat less than the principal arterial system.

Rural Collector Road System

The rural collector routes generally serve intracounty travel. These routes serve travel whose distances are shorter than on the arterial routes. The rural collector road system is subclassified into major and minor collector roads.

Major Collector Roads

These routes provide service to the larger towns not directly served by the higher systems and to other traffic generators of equivalent intracounty importance, such as consolidated schools, shipping points, county parks, significant mining and agricultural areas, etc. Major collector roads also link these places to routes of higher classification and serve the more important intracounty travel corridors.

Minor Collector Roads

These collect traffic from local roads and bring all developed areas within a reasonable distance of a major collector road. They also provide service to the remaining smaller communities and link the locally important traffic generators with the rural outskirts.

Rural Local Road System

The local roads are all roads that are not on a higher system. Local residential subdivision streets and residential collector streets are elements of the local road system. Local residential streets are either cul-de-sacs, loop streets less than 2,500 feet (762.2 m) in length, or streets less than one mile (1.6 km) in length. They do not connect thoroughfares or serve major traffic generators and do not collect traffic from more than one hundred dwelling units. Residential collectors serve as the connecting street system between local residential streets and the thoroughfare system.

Figure A-1 gives a schematic illustration of a functionally classified rural highway system. The functional classification for Burke County is Shown in Figure A-2.

Objectives of Thoroughfare Planning

Thoroughfare planning is the process public officials use to assure the development of the most appropriate street system that will meet existing and future travel desires within the urban area. The primary aim of a thoroughfare plan is to guide the development of the urban street system in a manner consistent with the changing traffic patterns. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and it helps eliminate unnecessary improvements, so needless expense can be averted. By developing the urban street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained, requiring a minimum amount of land for street purposes. In addition to providing for traffic needs the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population, commercial and industrial development affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

* To provide for the orderly development of an adequate major street system as land development occurs;

* To reduce travel and transportation costs;

* To reduce the cost of major street improvements to the public through the coordination of the street system with private action;

* To enable private interests to plan their actions, improvements, and development with full knowledge of public intent;

* To minimize disruption and displacement of people and businesses through long range advance planning for major street improvements;

* To reduce environmental impacts, such as air pollution, resulting from transportation, and

* To increase travel safety.

These objectives are achieved through improving both the operational efficiency of thoroughfares, and improving the system efficiency through system coordination and layout.

Operational Efficiency

A street's operational efficiency is improved by increasing the capability of the street to carry more vehicular traffic and people. In terms of vehicular traffic, a street's capacity is defined by the maximum number of vehicles which can pass a given point on a roadway during a given time period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity include:

* **Street widening** - widening of a street from two to four lanes more than doubles the capacity of the street by providing additional maneuverability for traffic.

* **Intersection improvements** - increasing the turning radii, adding exclusive turn lanes, and channelizing movements can improve the capacity of an existing intersection.

* **Improving vertical and horizontal alignment** -reduces the congestion caused by slow moving vehicles.

* **Eliminating roadside obstacles** - reduces side friction and improves a driver's field of sight.

Operational ways to improve street capacity include:

* **Control of access** -- a roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number.

* **Parking removal** -- Increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking and unparking vehicles.

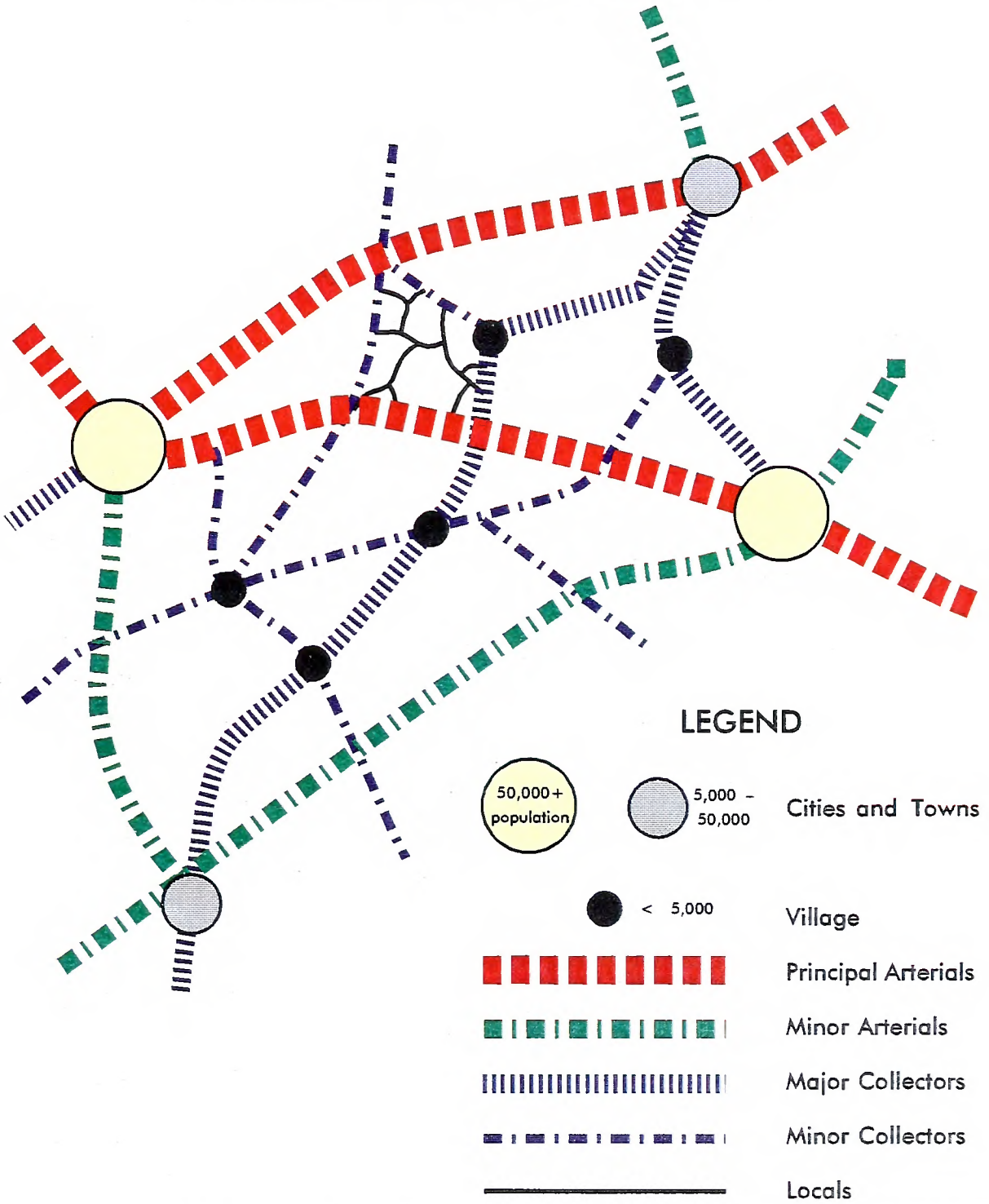
* **One-way operation** -- The capacity of a street can sometimes be increased 20-50%, depending upon turning movements and overall street width, by initiating one-way traffic operations. One-way streets can also improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.

* **Reversible lane** -- Reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods.

* **Signal phasing and coordination** -- Uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

Figure A–1

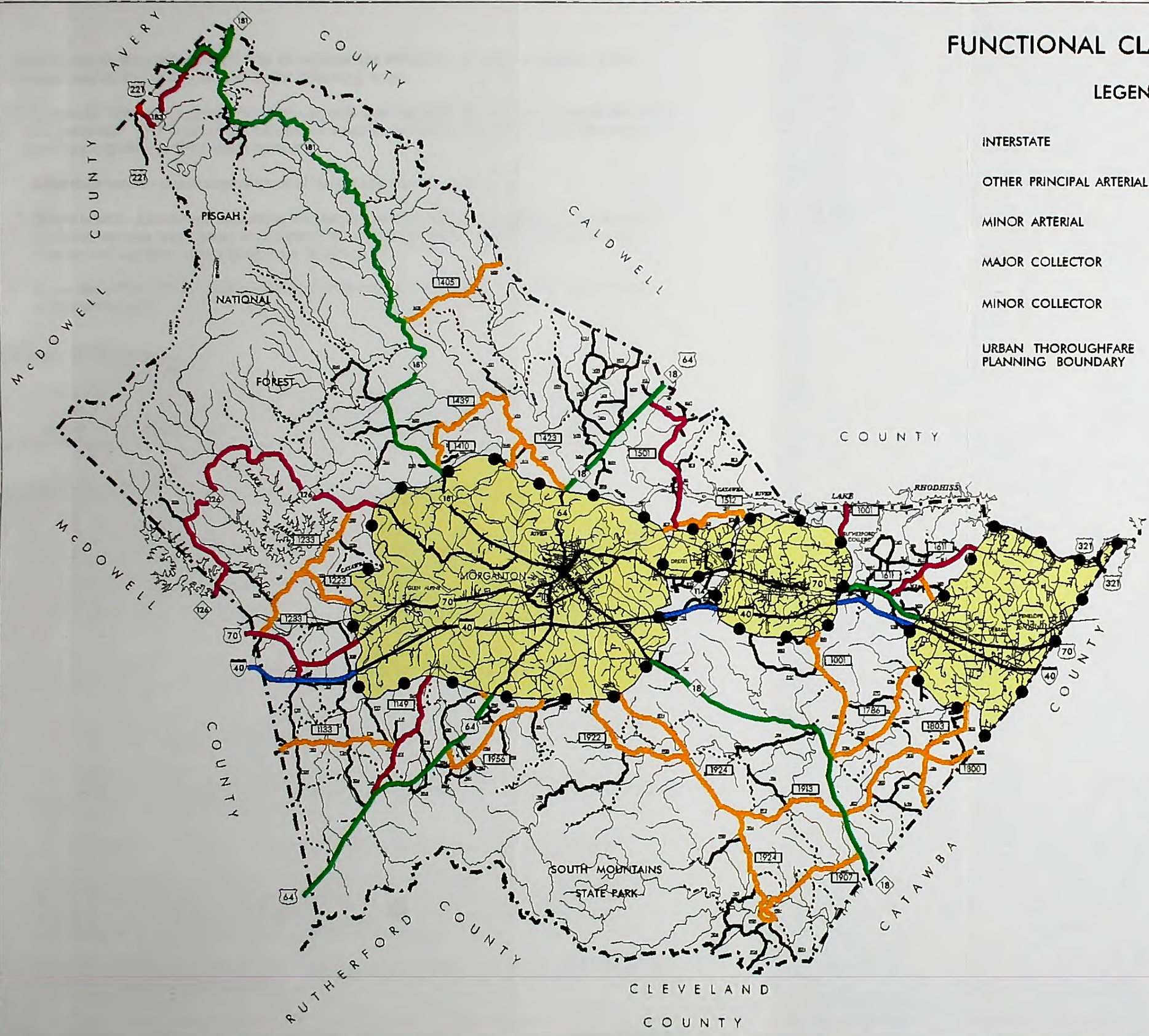
RURAL HIGHWAY NETWORK FUNCTIONAL CLASSIFICATION



FUNCTIONAL CLASSIFICATION

LEGEND

- INTERSTATE
- OTHER PRINCIPAL ARTERIAL
- MINOR ARTERIAL
- MAJOR COLLECTOR
- MINOR COLLECTOR
- URBAN THOROUGHFARE PLANNING BOUNDARY



BURKE COUNTY

NORTH CAROLINA

PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS–GIS UNIT
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

FIGURE A–2

Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced or altered in the following ways:

* **Carpools** - Encourage people to form carpools and vanpools for journeys to work and other trip purposes. This reduces the number of vehicles on the roadway and raises the people carrying capability of the street system.

* **Alternate mode** - Encourage the use of transit and bicycle modes.

* **Work hours** - Encourage industries, businesses, and institutions to stagger work hours or establish variable work hours for employees. This will spread peak travel over a longer time period and thus reduce peak hour demand.

* **Land use** - Plan and encourage land use development or redevelopment in a more travel efficient manner.

System Efficiency

Another means for altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost to the user. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Application of Thoroughfare Planning Principles

The concepts presented in the discussion of operational efficiency, system efficiency, functional classification, and idealized major thoroughfare system are the conceptual tools available to the transportation planner in developing a thoroughfare plan. In actual practice, thoroughfare planning is done for established urban area and is constrained by existing land use and street patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these and the many other factors that affect major street locations.

Through the thoroughfare planning process it is necessary from a practical viewpoint that certain basic principles be followed as closely as possible. These principles are listed below:

1. The plan should be derived from a thorough knowledge of today's travel - its component parts, and the factors that contribute to it, limit it, and modify it.

2. Traffic demands must be sufficient to warrant the designation and development of each major street. The thoroughfare plan should be designed to accommodate a large portion of major traffic movements on a few streets.

3. The plan should conform to and provide for the land development plan for the area.

4. Certain considerations must be given to urban development beyond the current planning period. Particularly in outlying or sparsely developed areas that have development potential, it is necessary to designate thoroughfares on a long-range planning basis to protect rights-of-way for future thoroughfare development.

5. While being consistent with the above principles and realistic in terms of travel trends, the plan must be economically feasible.

Appendix B

Thoroughfare Plan Street Tabulation and Recommendations

This appendix includes a detailed tabulation of all streets identified as elements of the Burke County Thoroughfare Plan. The table includes a description of each section, as well as the length, cross-section, and right-of-way for each section. Also included are existing and projected average daily traffic volumes, roadway capacity, and the recommended ultimate lane configuration. Due to space constraints, these recommended cross-sections are given in the form of an alphabetic code. A detailed description of each of these codes and a illustrative figure for each can be found in Appendix C.

The following index of terms may be helpful in interpreting the table:

MUPB - Morganton Urban Planning Boundary

HUPB - Hickory Urban Planning Boundary

RCUPB - Rutherford College Urban Planning Boundary

BRP - Blue Ridge Parkway

NFB - National Forest Boundary

ADQ - Adequate

Co - County

N/A - Not Available

Appendix B

Thoroughfare Plan Street Tabulation and Recommendations

FACILITY & SECTION	EXISTING CROSS-SECTION S.I. UNITS DIST km	RDWY m	ROW m	ENGLISH UNITS DIST MI	RDY FT	ROW FT	NUMBER of LANES	PRACTICAL CAPACITY CURRENT (FUTURE)	1995 ADTS	2025 ADTS	RECOMMENDED X - SECTION RDWAY (ULT)	ROW (ULT)
US 64												
McDowell Co. - SR 1965	10.6	6.7	30	6.60	22	100	2	8500	3200	5300	A	68.4m
SR 1965 - MUPB	3.46	6.7	30	2.15	22	100	2	8500	7900	13200	A	68.4m
US 64/NC 18												
MUPB - Caldwell Co.	12.9	7.3	30	8.00	24	100	2	9500	7300	11100	A	68.4m
US 70												
McDowell Co. - SR 1129	3.06	6.7	30	1.90	22	100	2	8500	1700	2400	ADQ	
SR 1129 - SR 1294	2.41	6.7	30	1.50	22	100	2	8500	2300	3300	ADQ	
SR 1294 - SR 1138	0.24	6.7	30	0.15	22	100	2	8500	2300	4100	ADQ	
SR 1138 - MUPB	0.56	6.7	30	0.35	22	100	2	8500	3900	6100	ADQ	
RCUPB - SR 1611	1.71	6.7	18	1.06	22	60	2	8800	8900	13300	F	33m
SR 1611 - SR 1620	0.82	6.7	15	0.52	22	50	2	8800	6200	11800	F	33m
SR 1620 - HUPB	1.48	6.7	15	0.92	22	50	2	8800	6400	11600	F	33m
NC 18												
Catawaba Co. - SR 1800	3.06	6.7	30	1.90	22	100	2	8500	4100	6900	A	68.4m
SR 1800 - SR 1001	3.38	7.3	30	2.10	24	100	2	9500	4700	7900	A	68.4m
SR 1001 - SR 1916	1.77	7.3	30	1.10	24	100	2	9500	4600	6800	A	68.4m
SR 1916 - MUPB	9.01	7.3	30	5.60	24	100	2	9500	4600	7600	A	68.4m
NC 126												
McDowell Co. - Linville River	10.2	5.5	30	6.36	18	100	2	6500	400	700	O	30m
Linville Riv. - SR 1244	8.05	5.5	30	5.00	18	100	2	6500	800	1100	O	30m
SR 1244 - SR 1233	1.43	5.5	30	0.89	18	100	2	6500	1500	2500	O	30m
SR 1233 - MUPB	2.14	5.5	30	1.33	18	100	2	6500	2400	4500	O	30m
NC 181												
MUPB - SR 1244	4.02	7.3	18	2.10	24	60	2	9500	6800	10900	A	68.4m
SR 1244 - SR 1405	7.72	7.3	18	4.80	24	60	2	9500	2900	4800	ADQ	
SR 1405 - NFB	8.37	7.3	18	5.20	24	60	2	9500	2200	3700	ADQ	
NFB - SR 1264	9.17	9.8	40	5.70	32	130	2	9500	1800	3500	ADQ	
SR 1264 - NC 183	4.80	7.3	40	2.98	24	130	2	9500	2200	4000	ADQ	
NC 183 - Avery Co.	1.43	7.3	46	0.89	24	150	2	9500	2300	4300	ADQ	
NC 183												
McDowell Co. - BRP	2.83	5.5	30	1.76	18	100	2	6000	1100	1900	K	30m
BRP - SR 1271	3.01	5.5	30	1.87	18	100	2	6000	600	1100	K	30m
SR 1271 - NC 181	1.43	5.5	30	0.89	18	100	2	6000	900	1500	K	30m

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FACILITY & SECTION	EXISTING CROSS-SECTION S.I. UNITS DIST km	RDWY m	ROW m	ENGLISH UNITS DIST MI	RDY FT	ROW FT	NUMBER of LANES	PRACTICAL CAPACITY CURRENT (FUTURE)	1995 ADTS	2025 ADTS	RECOMMENDED X - SECTION RDWAY (ULT)	ROW (ULT)
SR 1001 (Malcolm Boulevard)												
RCUPB - Caldwell Co.	1.46	6.1	30	0.91	20	100	2	7300	6500	11100	C	33m
RCUPB - SR 1737	2.20	6.1	N/A	1.37	20	N/A	2	7300	2500	4100	K	30m
SR 1737 - SR 1793	2.57	6.7	N/A	1.60	22	N/A	2	8500	1600	2600	K	30m
SR 1793 - NC 18	2.89	6.1	N/A	1.80	20	N/A	2	7300	1600	2600	K	30m
SR 1126 (Bennett Road)												
SR 1124 - SR 1127	2.25	5.5	N/A	1.40	18	N/A	2	6500	400	900	ADQ	
SR 1127 (Scott Road)												
SR 1124 - SR 1149	0.48	5.5	N/A	0.30	18	N/A	2	6500	400	900	ADQ	
SR 1129 (Dysartville Road)												
McDowell Co. - I-40	7.72	5.5	18	4.80	18	60	2	6500	2600	4900	K	30m
I-40 - US 70	0.97	5.5	N/A	0.60	18	N/A	2	6500	1900	3400	K	30m
SR 1133 (Patton Road)												
SR 1124 - SR 1129	2.90	6.1	N/A	1.80	20	N/A	2	7300	400	900	ADQ	
SR 1149 (Conley Road)												
US 64 - SR 1127	2.90	7.3	15	1.80	24	50	2	9500	600	1100	ADQ	
SR 1127 - SR 1118	1.61	7.3	12	1.00	24	40	2	9500	2100	4000	ADQ	
SR 1118 - MUPB	2.67	6.4	12	1.66	21	40	2	8000	3300	6300	K	30m
SR 1233 (North Power House Road)												
US 70 - SR 1223	4.18	5.5	N/A	2.60	18	N/A	2	6500	1300	2200	K	30m
SR 1223 - SR 1228	2.10	5.5	N/A	2.10	18	N/A	2	6500	400	800	K	30m
SR 1228 - NC 126	1.35	5.5	N/A	0.84	18	N/A	2	6500	700	1200	K	30m
SR 1405 (Brown Mountain Beach Road)												
NC 181 - Caldwell Co.	6.60	5.5	N/A	4.10	18	N/A	2	6000	400	600	O	30m
SR 1410 (Goodman Lake Road)												
NC 181 - SR 1439	2.74	5.5	18	1.70	18	60	2	6000	900	1800	K	30m
SR 1423 (Piedmont Road)												
US 64/NC 18 - SR 1439	6.76	5.5	N/A	4.20	18	N/A	2	6000	800	1400	K	30m
SR 1439 (Henderson Mill Road)												
NC 181 - SR 1410	2.74	5.5	18	1.70	18	60	2	6000	500	1000	K	30m
SR 1410 - SR 1439	4.67	5.5	18	2.90	18	60	2	6000	300	700	K	30m

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FACILITY & SECTION	EXISTING CROSS-SECTION S.I. UNITS DIST km	RDWY m	ROW m	ENGLISH UNITS DIST MI	RDY FT	ROW FT	NUMBER of LANES	PRACTICAL CAPACITY CURRENT (FUTURE)	1995 ADTS	2025 ADTS	RECOMMENDED X - SECTION RDWAY (ULT)	ROW (ULT)
SR 1501 (Antioch Road)												
US 64/NC 18 - SR 1584	2.41	5.5	N/A	1.50	18	N/A	2	6500	1400	2900	K	30m
SR 1584 - SR 1515	3.70	5.5	N/A	2.30	18	N/A	2	6500	1500	4200	K	30m
SR 1515 - SR 1512	3.25	6.1	30	2.02	20	100	2	7300	1800	4600	K	30m
SR 1512 (Amherst Road)												
MUPB - SR 1544	6.55	5.5	N/A	4.07	18	N/A	2	6500	900	1900	K	30m
SR 1611 (Rhodhiss Road)												
US 70 - SR 1619	0.82	6.1	N/A	0.51	20	N/A	2	7300	2500	3900	K	30m
SR 1619 - SR 1618	1.46	6.1	N/A	0.91	20	N/A	2	7300	2100	4300	K	30m
SR 1618 - HUPB	2.53	6.1	N/A	1.57	20	N/A	2	7300	2700	5200	K	30m
SR 1618 (Icard School Road)												
SR 1611 - HUPB	1.80	5.5	N/A	1.12	18	N/A	2	6500	1300	3600	K	30m
SR 1736 (Wilkies Grove Road)												
Catawba Co. - SR 1800	2.90	5.5	18	1.80	18	60	2	6500	1000	1800	ADQ	
SR 1786 (Miller Bridge Road)												
NC 18 - SR 1793	5.15	6.1	N/A	3.20	20	N/A	2	7300	1300	3200	K	30m
SR 1793 - HUPB	1.77	6.1	N/A	1.10	20	N/A	2	7300	2600	7000	K	30m
SR 1800 (George Hildebran School Road)												
NC 18 - SR 1796	1.77	5.5	18	1.10	18	60	2	6500	1500	2400	K	30m
SR 1796 - SR 1736	4.35	5.5	18	2.70	18	60	2	6500	1400	2400	K	30m
SR 1736 - Catawba Co.	2.74	5.5	18	1.70	18	60	2	6500	1700	3100	K	30m
SR 1803 (Johnson Bridge Road)												
SR 1800 - HUPB	4.67	5.5	N/A	2.90	18	N/A	2	6500	1000	1600	K	30m
SR 1907 (Rhoney Road)												
NC 18 - SR 1924	7.08	5.5	N/A	4.40	18	N/A	2	6500	800	2200	K	30m
SR 1913 (Sugar Loaf Road)												
NC 18 - SR 1924	6.92	5.5	18	4.30	18	60	2	6500	1100	2100	K	30m
SR 1922 (Enola Road)												
SR 1924 - SR 1917	2.57	6.1	18	1.60	20	60	2	7300	700	1200	ADQ	
SR 1917 - SR 1920	1.29	6.1	18	0.80	20	60	2	7300	900	1900	ADQ	
SR 1920 - MUPB	3.48	5.5	N/A	2.16	18	N/A	2	6500	1700	2500	K	30m

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FACILITY & SECTION	EXISTING CROSS-SECTION S.I. UNITS DIST km	RDWY m	ROW m	ENGLISH UNITS DIST MI	RDY FT	ROW FT	NUMBER of LANES	PRACTICAL CAPACITY CURRENT (FUTURE)	1995 ADTS	2025 ADTS	RECOMMENDED X - SECTION RDWAY (ULT)	ROW (ULT)
SR 1924 (Old NC 18)												
Cleveland Co. - SR 1913	9.33	5.5	N/A	5.80	18	N/A	2	6500	700	1000	O	30m
SR 1913 - SR 1922	4.06	5.5	N/A	2.50	18	N/A	2	6500	700	1000	O	30m
SR 1922 - MUPB	5.38	5.5	N/A	3.34	18	N/A	2	6500	1400	2300	O	30m
SR 1956 (Jenkins Road)												
SR 1965 - SR 1957	7.84	5.5	N/A	4.87	18	N/A	2	6500	1400	2800	K	30m
SR 1957 - MUPB	0.37	5.5	N/A	0.23	18	N/A	2	6500	2700	4000	K	30m

Appendix C

Typical Cross Sections

Cross section requirements for thoroughfares vary according to the desired capacity and level of service to be provided. Universal standards in the design of thoroughfares are not practical. Each street section must be individually analyzed and its cross section requirements determined on the basis of amount and type of projected traffic, existing capacity, desired level of service, and available right-of-way. Typical cross section recommendations are shown in Figure C-1. These cross sections are typical for facilities on new location and where right-of-way constraints are not critical. For widening projects and urban projects with limited right-of-way, special cross sections should be developed that meet the needs of the project.

The recommended typical cross sections shown in Appendix B, Table B-1 were derived on the basis of projected traffic, existing capacities, desirable levels of service, and available right-of-way.

On all existing and proposed major thoroughfares delineated on the thoroughfare plan, adequate right-of-way should be protected or acquired for the ultimate cross sections. Ultimate desirable cross sections for each of the thoroughfares are listed in Appendix B. Recommendations for "ultimate" cross sections are provided for the following:

1. thoroughfares which may require widening after the current planning period
2. thoroughfares which are borderline adequate and accelerated traffic growth could render them deficient
3. thoroughfares where an urban curb and gutter cross section may be locally desirable because of urban development or redevelopment.

Recommended design standards relating to grades, sight distances, degree of curve, super elevation, and other considerations for thoroughfares are given in Appendix D.

A - Four Lanes Divided with Median - Freeway

Typical for four lane divided highways in rural areas which may have only partial or no control of access. The minimum median width for this cross section is 14 m (46 feet), but a wider median is desirable.

B - Seven Lanes - Curb & Gutter

This cross section is not recommended for new projects. When the conditions warrant six lanes, cross section "D" should be recommended. Cross section "B" should be used only in special situations such as when widening from a five lane section and right-or-way is limited. Even in these situations, consideration should be given to converting the center turn lane to a median so that cross section "D" is the final cross section.

C - Five Lanes - Curb & Gutter

Typical for major thoroughfares, this cross section is desirable where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

D - Six Lanes Divided with Raised Median - Curb & Gutter/ E - Four Lanes Divided with Raised Median - Curb & Gutter

These cross sections are typically used on major thoroughfares where left turns and intersection streets are not as frequent. Left turns would be restricted to a few selected intersections. The 4.8 m (16 ft) median is the minimum recommended for an urban boulevard type cross section. In most instances, monolithic construction should be utilized due to greater cost effectiveness, ease and speed of placement, and reduced future maintenance requirements. In special cases, grassed or landscaped medians result in greatly increased maintenance costs and an increase danger to maintenance personnel. Non-monolithic medians should only be recommended when the above concerns are addressed.

F - Four Lanes Divided - Boulevard, Grass Median

Recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 7.3 m (24 ft) is recommended with 9.1 m (30 ft) being desirable.

G - Four Lanes - Curb & Gutter

This cross section is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections. This cross section should be used only if the above criteria is met. If right-of-way is not restricted, future strip development could take place and the inner lanes could become de facto left turn lanes.

H - Three Lanes - Curb & Gutter

In urban environments, thoroughfares which are proposed to function as one-way traffic carriers would typically require cross section "H".

I - Two Lanes - C&G, Parking both sides: J - Two Lanes - C&G, Parking one side

Cross sections "I" and "J" are usually recommended for urban minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "I" would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.

K - Two Lanes - Paved Shoulder

This cross section is used in rural areas or for staged construction of a wider multi-lane cross section. On some thoroughfares, projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time. For areas that are growing and future widening will be necessary, the full right-of-way of 30 m (100 ft) should be required. In some instances, local ordinances may not allow the full 30 m. In those cases, 21 m (70 ft) should be preserved with the understanding that the full 30 m will be preserved by use of building setbacks and future street line ordinances.

L - Six Lanes Divided with Grass Median - Freeway

Cross section "L" is typical for controlled access freeways. The 14 m (46 ft) grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Right-of-way requirements would typically vary upward from 70 m (228 ft) depending upon cut and fill requirements.

M - Eight Lanes Divided with Raised Median - Curb & Gutter

Also used for controlled access freeways, this cross section may be recommended for freeways going through major urban areas or for routes projected to carry very high volumes of traffic.

N - Five Lanes/C&G, Widened Curb Lanes; O - Two Lane/Shoulder Section; P - Four Lanes Divided/Raised Median, C&G, Widened Curb Lanes

If there is sufficient bicycle travel along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to contain the bicycle facilities. The North Carolina Bicycle Facilities Planning and Design Guidelines should be consulted for design standards for bicycle facilities. Cross sections "N", "O", and "P" are typically used to accommodate bicycle travel.

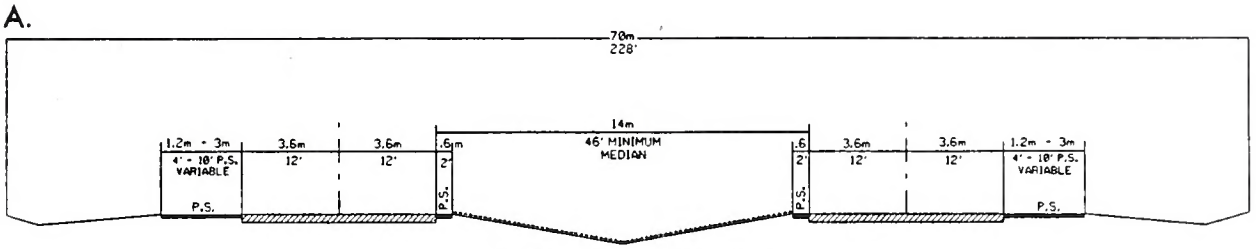
General

The urban curb and gutter cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk farther away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

The right-of-ways shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

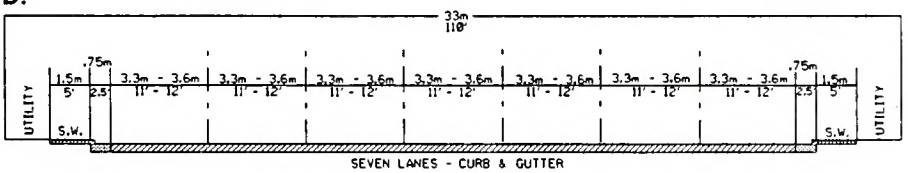
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



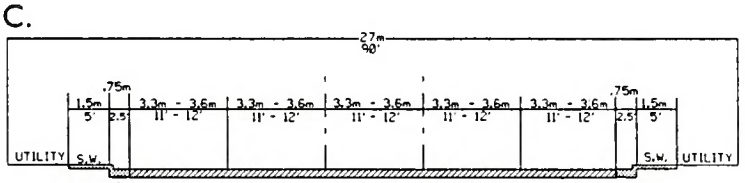
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



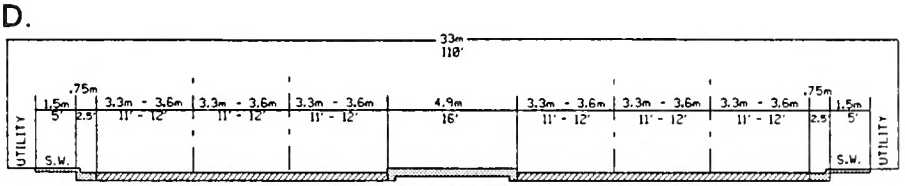
SEVEN LANES - CURB & GUTTER

C.



FIVE LANES - CURB & GUTTER

D.

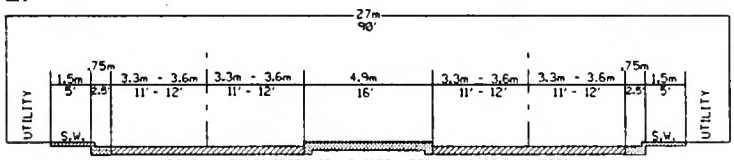


SIX LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

FIGURE C–1

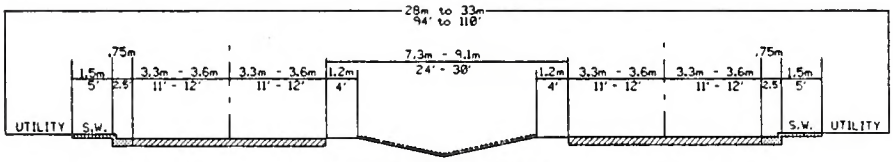
TYPICAL THOROUGHFARE CROSS SECTIONS

E.



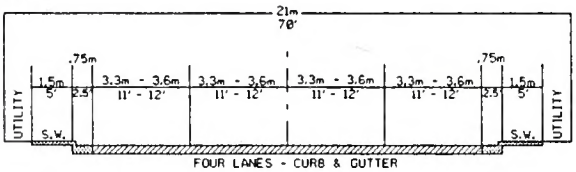
FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

F.



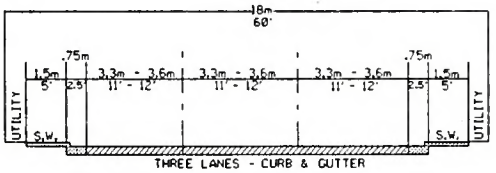
FOUR LANES DIVIDED - BOULEVARD
GRASS MEDIAN

G.



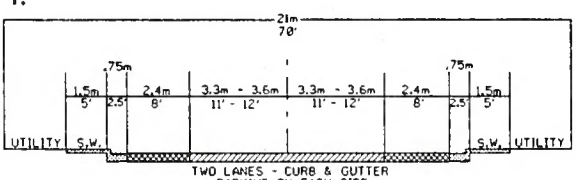
FOUR LANES - CURB & GUTTER

H.



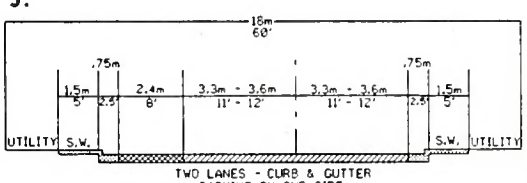
THREE LANES - CURB & GUTTER

I.



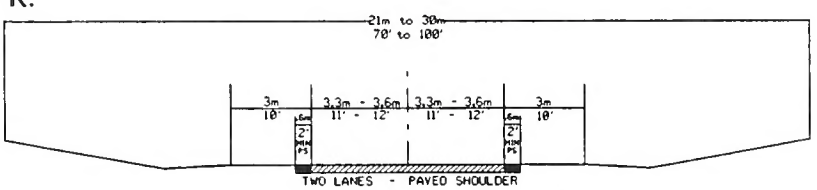
TWO LANES - CURB & GUTTER
PARKING ON EACH SIDE

J.



TWO LANES - CURB & GUTTER
PARKING ON ONE SIDE

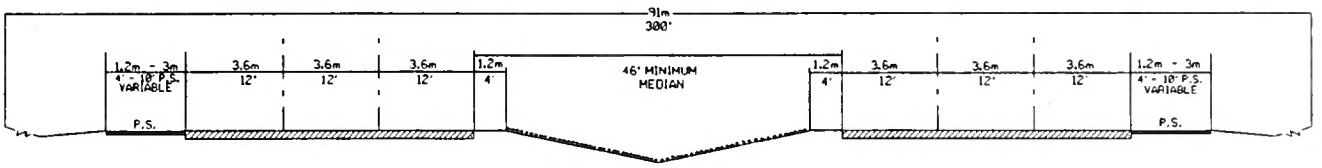
K.



TWO LANES - PAVED SHOULDER

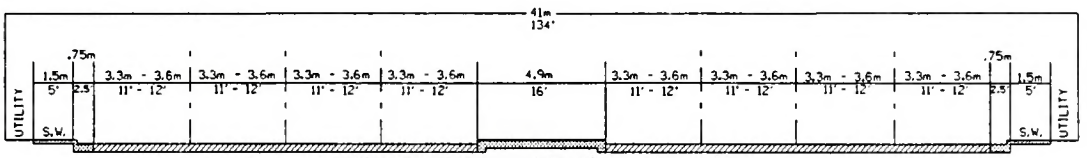
TYPICAL THOROUGHFARE CROSS SECTIONS

L.



SIX LANES DIVIDED WITH GRASS MEDIAN - FREEWAY

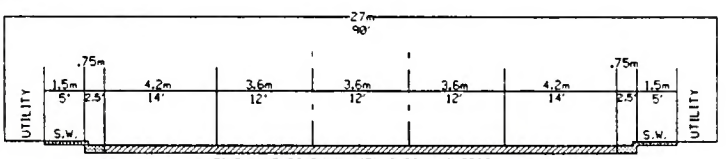
M.



EIGHT LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

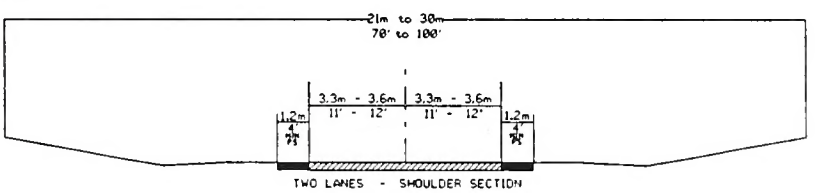
TYPICAL THOROUGHFARE CROSS SECTIONS FOR ACCOMMODATING BICYCLES

N.



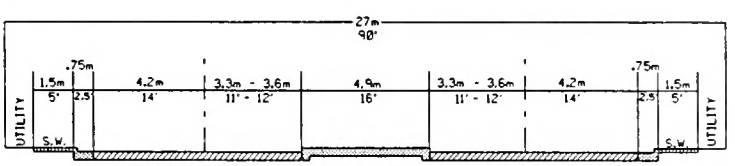
FIVE-LANE ROADWAY WITH CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

O.



TWO LANES - SHOULDER SECTION

P.



FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

Appendix D

Recommended Minimum Requirements for Subdivisions

Definitions

Streets and Roads

Rural Roads

1. *Principal Arterial* - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.

2. *Minor Arterial* - A rural roadway joining cities and larger towns and providing intra-state and inter-county service at relatively high overall travel speeds with minimum interference to through movement.

3. *Major Collector* - A road which serves major intra-county travel corridors and traffic generators and provides access to the Arterial system.

4. *Minor Collector* - A road which provides service to small local communities and traffic generators and provides access to the Major Collector system.

5. *Local Road* - A road which serves primarily to provide access to adjacent land, over relatively short distances.

Urban Streets

1. *Major Thoroughfares* - Major thoroughfares consist of Inter-state, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. *Minor Thoroughfares* - Minor thoroughfares perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.

3. *Local Street* - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

Specific Type Rural or Urban Streets

1. *Freeway, expressway, or parkway* - Divided multilane roadways designed to carry large volumes of traffic at high speeds. A *freeway* provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. An *expressway* is a facility with full or partial control of access and generally with grade separations at major intersections. A *parkway* is for non-commercial traffic, with full or partial control of access.

2. *Residential Collector Street* - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

3. *Local Residential Street* - Cul-de-sacs, loop streets less than 760 meters (2500 ft) in length, or streets less than 1.6 kilometers (1.0 miles) in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.

4. *Cul-de-sac* - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.

5. *Frontage Road* - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.

6. *Alley* - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

Property

Building Setback Line

A line parallel to the street in front of which no structure shall be erected.

Easement

A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

Lot

A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plat" and "parcel".

Subdivision

Subdivider

Any person, firm, corporation or official agent thereof, who subdivides of develops any land deemed to be a subdivision.

Subdivision

All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets.

The following shall not be included within this definition nor subject to these regulations:

* The combination or re-combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein
* the division of land into parcels greater than 4 hectares (10 acres) where no street right-of-way dedication is involved

* the public acquisition, by purchase, of strips of land for the widening or the opening of streets
* the division of a tract in single ownership whose entire area is no greater than 0.8 hectares (2 acres) into not more than three lots, where no street right-of-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

Dedication

A gift, by the owner, of his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

Reservation

Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

DESIGN STANDARDS

Streets and Roads

The design of all roads within the Planning Area shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the County. The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

Right-of-way Widths

Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

The subdivider will only be required to dedicate a maximum of 30 meters (100 ft) of right-of-way. In cases where over 30 meters (100 ft) of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 30 meters (100 ft). On all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width right-of-way, not less than 18 meters (60 ft) in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is sub-divided, the remainder of the full required right-of-way shall be dedicated.

Table D-1

Minimum Right-of-way Requirements

Area Classification	Functional Classification	Minimum ROW
RURAL	Principle Arterial	Freeways- 105 m (350 ft) Other- 60 m (200 ft)
	Minor Arterial	30 m (100 ft)
	Major Collector	30 m (100 ft)
	Minor Collector	24 m (80 ft)
	Local Road	18 m1 (60 ft)
URBAN	Major Thoroughfare	27 m (90 ft)
	Minor Thoroughfare	21 m (70 ft)
	Local Street	18 m1 (60 ft)
	Cul-de-sac	variable2

[1]The desirable minimum right-of-way (ROW) is 18 meters (60 ft). If curb and gutter is provided, 15 meters (50 ft) of ROW is adequate on local residential streets.

[2]The ROW dimension will depend on radius used for vehicular turn around. Distance from edge of pavement of turn around to ROW should not be less than distance from edge of pavement to ROW on street approaching turn around.

Street Widths

Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. *Local Residential*

    * Curb and Gutter section
        * 7.8 meters (26 ft), face to face of curb
    * Shoulder section
        * 6 meters (20 ft) to edge of pavement, 1.2 meters (4 ft) for shoulders

2. *Residential Collector*

    * Curb and Gutter section
        * 10.2 meters (34 ft), face to face of curb
    * Shoulder section
        * 6 meters (20 ft) to edge of pavement, 1.8 meters (6 ft) for shoulders

Geometric Characteristics

The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

1. *Design Speed* - The design speed for a roadway should be a minimum of 10 km/h (5 mph) greater than the posted speed limit. The design speeds for subdivision type streets are shown in Tables D-2 (metric) and D-3 (english).

2. *Minimum Sight Distance* - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the parameters set forth in Tables D-4 (metric) and D-5 (english).

3. *Superelevation* - Tables D-6 (metric) and D-7 (english) show the minimum radius and the related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

4. *Maximum and Minimum Grades*

    * the maximum grades in percent are shown in Table D-8 (metric) and D-9 (english)
    * minimum grade should not be less then 0.5%
    * grades for 30 meters (100 ft) each way from intersections (measured from edge of pavement) should not exceed 5%

Table D-2

Design Speeds (Metric)

Facility Type	Design Speed (km/h) Desirable	Minimum Level	Minimum Rolling
RURAL			
Minor Collector Roads (ADT Over 2000)	100	80	60
Local Roads1 (ADT Over 400)	80	80	60
URBAN			
Major Thoroughfares2	100	60	60
Minor Thoroughfares	100	50	50
Local Streets	50	50	30

[1]Local Roads including Residential Collectors and Local Residential.

[2]Major Thoroughfares other than Freeways or Expressways.

Table D-3

Design Speeds (English)

Facility Type	Design Speed (mph) Desirable	Minimum Level	Minimum Rolling
RURAL			
Minor Collector Roads (ADT Over 2000)	60	50	40
Local Roads1 (ADT Over 400)	50	* 50	* 40
URBAN			
Major Thoroughfares2	60	50	40
Minor Thoroughfares	40	30	30
Local Streets	30	** 30	** 20

Note: *Based on ADT of 400-750. Where roads serve a limited area and small number of units, can reduce minimum design speed. **Based on projected ADT of 50-250. (Reference NCDOT Roadway Design Manual page 1-1B)

[1]Local Roads including Residential Collectors and Local Residential.

[2]Major Thoroughfares other than Freeways or Expressways.

Table D-4

Sight Distance (Metric)

Design Speed (km/h)	Stopping Sight Distance (meters) Desirable	Minimum	Minimum K[1] Values (meters) Crest Curve	Sag Curve	Passing Sight Distance (meters) For 2-lanes
30	30	29.6	3	4	*
50	70	57.4	9	11	*
60	90	74.3	14	15	*
90	170	131.2	43	30	*
100	210	157.0	62	37	*

Note: General practice calls for vertical curves to be multiples of 10 meters. Calculated lengths shall be rounded up in each case. *Minimum passing distance for 2-lanes is currently under revision. (Reference NCDOT Roadway Metric Design Manual page 1-12 T-1)

[1]K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length of the vertical curve which will provide the desired sight distance. Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1990".

Table D-5

Sight Distance (English)

Design Speed (mph)	Stopping Sight Distance (feet)		Minimum K[1] Values (feet)		Passing Sight Distance (feet)
	Desirable	Minimum	Crest Curve	Sag Curve	For 2-lanes
30	200	200	30	40	1100
40	325	275	60	60	1500
50	475	400	110	90	1800
60	650	525	190	120	2100

Note: General practice calls for vertical curves to be multiples of 50 feet. Calculated lengths shall be rounded up in each case. (Reference NCDOT Roadway Design Manual page 1-12 T-1)

[1]K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length of the vertical curve which will provide the desired sight distance. Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1990".

Table D-6

Superelevation Table (Metric)

Design Speed (km/h)	Minimum Radius of Maximum e[1]		
	e=0.04	e=0.06	e=0.08
50	100	90	80
65	175	160	145
80	280	250	230
100	490	435	395

[1]e = rate of roadway superelevation, meter per meter

Table D-7

Superelevation Table (English)

Design Speed (km/h)	Minimum Radius of Maximum e[1]			Maximum Degree of Curve		
	e=0.04	e=0.06	e=0.08	e=0.04	e=0.06	e=0.08
50	302	273	260	19 00'	21 00'	22 45'
65	573	521	477	10 00'	11 15'	12 15'
80	955	955	819	6 00'	6 45'	7 30'
100	1,637	1,432	1,146	3 45'	4 15'	4 45'

[1]e = rate of roadway superelevation, foot per foot

Note: (Reference NCDOT Roadway Design Manual page 1-12 T-6 thru T-8)

Table D-8

Maximum Vertical Grade (Metric)

Facility Type and Design Speed (km/h)	Maximum Grade in Percent		
	Flat	Rolling	Mountainous
RURAL			
Minor Collector Roads*			
30	7	10	12
50	7	9	10
65	7	8	10
80	6	7	9
100	5	6	8
110	4	5	6
Local Roads*1			
30	-	11	16
50	7	10	14
65	7	9	12
80	6	8	10
100	5	6	-
URBAN			
Major Thoroughfares2			
50	8	9	11
65	7	8	10
80	6	7	9
100	5	6	8
Minor Thoroughfares*			
30	9	12	14
50	9	11	12
65	9	10	12
80	7	8	10
100	6	7	9
110	5	6	7
Local Streets*			
30	-	11	16
50	7	10	14
65	7	9	12
80	6	8	10
100	5	6	-

Note: *For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters (500 ft) long, grades may be 2% steeper than the values in the above table.(Reference NCDOT Roadway Metric Design Manual page 1-12 T-3)

[1]Local Roads including Residential Collectors and Local Residential.

[2]Major Thoroughfares other than Freeways or Expressways.

Table D-9

Maximum Vertical Grade (English)

Facility Type and Design Speed (mph)	Maximum Grade in Percent		
	Flat	Rolling	Mountainous
RURAL			
Minor Collector Roads*			
20	7	10	12
30	7	9	10
40	7	8	10
50	6	7	9
60	5	6	8
70	4	5	6
Local Roads*1			
20	-	11	16
30	7	10	14
40	7	9	12
50	6	8	10
60	5	6	-
URBAN			
Major Thoroughfares2			
30	8	9	11
40	7	8	10
50	6	7	9
60	5	6	8
Minor Thoroughfares*			
20	9	12	14
30	9	11	12
40	9	10	12
50	7	8	10
60	6	7	9
70	5	6	7
Local Streets*			
20	-	11	16
30	7	10	14
40	7	9	12
50	6	8	10
60	5	6	-

Note: *For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters (500 ft) long, grades may be 2% steeper than the values in the above table.(Reference NCDOT Roadway Metric Design Manual page 1-12 T-3)

[1]Local Roads including Residential Collectors and Local Residential.

[2]Major Thoroughfares other than Freeways or Expressways.

Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Off-set intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 60 meters (200 ft) between survey centerlines.

Cul-de-sacs

Cul-de-sacs shall not be more than one hundred and fifty (150) meters (500 ft) in length. The distance from the edge of pavement on the vehicular turn around to the right-of-way line should not be less than the distance from the edge of pavement to right-of-way line on the street approaching the turn around. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street.

Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provisions are made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least 6.0 meters (20 ft).

3. Dead-end alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turn around facilities at the dead-end as may be required by the Planning Board.

Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 9.0 meters (30 ft) from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 1.8 meters (6 ft) from the face of curb.

Wheel Chair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:

* shoulder section approach

    * under 800 ADT design year - minimum 8.4 meters (28 ft) width face to face of parapets, rails, or pavement width plus 3 meters (10 ft), whichever is greater

    * 800 - 2000 ADT design year - minimum 10.2 meters (34 ft) width face to face of parapets, rails, or pavement width plus 3.6 meters (12 ft), whichever is greater

    * over 2000 ADT design year - minimum width of 12 meters (40 ft), desirable width of 13.2 meters (44 ft) width face to face of parapets or rails

* curb and gutter approach
    * under 800 ADT design year - minimum 7.2 meters (24 ft) face to face of curbs

    * over 800 ADT design year - width of approach pavement measured face to face of curbs.

* where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be a minimum of 450 millimeters (1' 6"), or greater if sidewalks are required

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

* shoulder section approach - Width of approach pavement plus width of usable shoulders on the approach left and right. (shoulder width 2.4 m (8 ft) minimum, 3 m (10 ft) desirable.)

* curb and gutter approach - Width of approach pavement measured face to face of curbs.

Appendix E

Index for Secondary Road Numbers

* SR 1001 - Malcolm Boulevard
* SR 1126 - Bennett Road
* SR 1127 - Scott Road
* SR 1129 - Dysartville Road
* SR 1131 - Pinnacle Church Road
* SR 1133 - Patton Road
* SR 1149 - Conley Road
* SR 1223 - Power House Road
* SR 1233 - North Power House Road
* SR 1405 - Brown Mountain Beach Road
* SR 1410 - Goodman Lake Road
* SR 1419 - Bost Road
* SR 1423 - Piedmont Road
* SR 1439 - Henderson Mill Road
* SR 1440 - Bost Road
* SR 1440 - Spainhour Road
* SR 1501 - Antioch Road
* SR 1512 - Amherst Road
* SR 1525 - Zion Road
* SR 1531 - North Drexel Road
* SR 1611 - Rhodhiss Road
* SR 1613 - Thomlinson Loop Road
* SR 1614 - Oak Ridge Church Road
* SR 1618 - Icard School Road
* SR 1736 - Wilkies Grove Road
* SR 1786 - Miller Bridge Road
* SR 1800 - G Hildebrand School Road
* SR 1803 - Johnson Bridge Road
* SR 1907 - Rhoney Road
* SR 1913 - Sugar Loaf Road
* SR 1922 - Enola Road
* SR 1924 - Old NC 18
* SR 1956 - Burkemont Road
* SR 1956 - Jenkins Road
* SR 1965 - Branstrom Orchard Street
* SR 1965 - Jenkins Road